McGraw-Hill Publishing Company, Inc. NOVEMBER, 1938 Price 35c. per copy

AVIATION

The Oldest American Aeronautical Magazine

Honors for the Army

WITH A WASP-POWERED LOCKHEED

PRATT & WHITNEY, U.S.A. DEPENDABLE ENGINES

PRATT & WHITNEY AIRCRAFT

UNITED AIRCRAFT CORPORATION EAST HARTFORD, CONNECTICUT

WHAT IT TAKES TO MAKE A POUND OF ALUMINUM

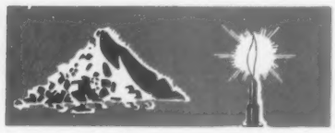
BAUXITE. The commonly used ore. It is found in many countries. Ours comes from Arkansas and Dutch Guiana. Aluminum is present, not as metal, but in the form of complicated chemical compounds. All the following raw materials are needed to get the aluminum out:

SODA ASH AND LIME. Add water to these, heat the solution and digest the *bauxite* in it. Aluminum compounds dissolve. Impurities are left behind as mud. From the filtered solution, something called *aluminum hydrate* is separated. Heat the *hydrate* to drive out water, and you have alumina, a white powder, chemically labelled as aluminum oxide. It sounds simple, but this is really a very technical, expensive process.

CRYOLITE. Translucent "Ice-rock," found naturally only in distant Greenland, but also made synthetically. To get the actual metal out of the *alumina*, the powder first has to be dissolved in a bath of molten *cryolite*.

COKE, TAR AND PITCH. Metallic aluminum is made in a steel pot thickly lined with *carbon*, which contains the molten bath of cryolite and dissolved alumina. Carbon blocks are hung in the bath, and a heavy electrical current is passed from the blocks through the bath to the lining of the pot. This current changes the oxide, *alumina*, to the metal, *aluminum*. Carbon blocks and linings are made from *coke*, *tar* and *pitch*.

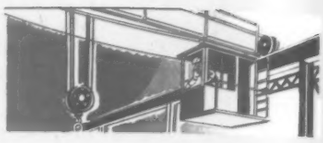
Each pound of virgin aluminum used to make the light, strong alloys of Alcoa Aluminum requires nine pounds of the foregoing materials. And equally vital:



FUEL. The process of getting *alumina* from *bauxite* uses 22,000 cubic feet of gas, or equivalent coal, for each ton of final metal. Coal also is consumed in baking the carbon blocks used in the reduction pots.

ELECTRICITY. Twelve kilowatt-hours of electrical energy must be generated to produce one pound of aluminum. The energy needed for a ton of aluminum would supply the electrical needs of the average home for thirty-five years. That is why we have invested millions in dams, reservoirs and power houses, through which, when running full, flows enough water to supply the needs of 92 cities the size of New York.

TRANSPORTATION. From mine to refinery to reduction plant our aluminum-in-the-making has to be shipped and reshipped to locations where all these raw materials are best available. Our transportation bill, just for getting aluminum made, was more than $5,000,000 last year.



LABOR. Labor is important in every one of these operations. Wages constitute the largest item in the cost of making aluminum.

SKILL. Every step of the process must be supervised and co-ordinated by men who "know-how." Hundreds of men in laboratories must continually check not only the raw materials but every pound of metal produced.

MONEY. The wherewithal which develops mines, builds and equips the necessary refinery and reduction plants, the dams, reservoirs and power houses, must be available.

All these are needed to make virgin aluminum, which is only a starting point for the light, strong alloys needed in aircraft construction. What it takes to make them would make a fascinating narrative of long, close cooperation with aircraft builders. For an idea of the requisites, read again the paragraph above captioned "Skill". ALUMINUM COMPANY OF AMERICA, *2182 Gulf Building, Pittsburgh, Pa.*

ALCOA

ALUMINUM COMPANY ★ OF ★ AMERICA

COMFORTABLE CABIN FOR TWO LARGE PEOPLE

STURDILY CONSTRUCTED FUSELAGE

FULL-SWIVEL TAIL WHEEL

COMPLETE!

Nothing More to Buy with the New

1939 CUB COUPE

Get this luxurious 1939 Cub Coupe and you've got everything! Here's a plane that's *complete* in every detail. Its wide, comfortable, deeply upholstered cabin seats two big people side-by-side with room to spare. With its 50-horsepower engine, it takes-off in a hurry, climbs rapidly and gives 90 miles per hour performance. Yet its economy is amazing, using only 3.6 gallons of gas per hour and very little oil. Hydraulic brakes, streamlined, hydraulic landing gear, Goodrich air wheels, wheel pants, full-swivel tail wheel, compass, air speed indicator, navigation lights and battery, elevator tab, and 15-gallon tank give the 1939 Cub Coupe a luxury and a completeness heretofore available only in ships costing many hundreds of dollars more.

At only $1995 F.A.F. Lock Haven, Pa.—or $665 down with easy monthly payments—the new 1939 Cub Coupe is the lowest-priced COMPLETE plane ever built!

For Only $419 Down You Can Get a CUB & Learn to Fly FREE!

Every purchaser of a new Cub is entitled to a free flying course, including dual flight instruction by a government licensed instructor. You can get a new Cub for only $419 down and learn to fly your own plane without paying a cent for dual instruction. See the new Cubs at your dealer's and ask for free flight demonstration . . . Trainer $419 down, Sport as low as $465 down, Coupe $665 down.

FREE CATALOG!

Send today for catalog on the new Cub Coupe and other models, the free flying course and name of your Cub dealer. Paste coupon—or write your request—on penny post card, if you wish. Piper Aircraft Corp., 118 A Street, Lock Haven, Pa., U.S.A. . . . Cub Aircraft Co., Ltd., Copenhagen, Denmark and Cub Aircraft Ltd., Hamilton, Canada.

PIPER AIRCRAFT CORPORATION
118 A Street, Lock Haven, Pa., U. S. A.

Please send me your free catalog on the new Cub Coupe and other Cub models, full details on the free flying course and name of my Cub dealer.

NAME_____

ADDRESS_____

CITY_____ STATE_____

COUNT THE CUBS THE WORLD'S FASTEST SELLING AIRPLANE

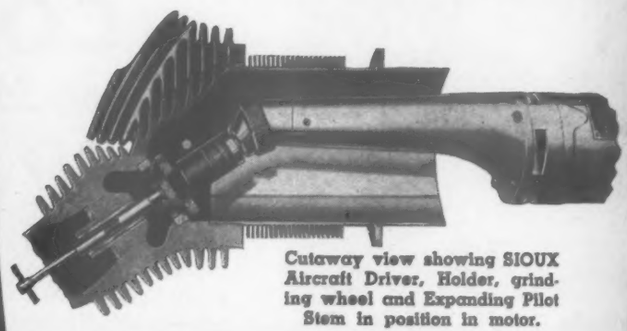
Published monthly, price 35c a copy. Subscription rates—United States, Canada, Mexico and Central American Countries, $3.00 a year. All other countries, $6.00 a year or 34 shillings. Entered as second-class matter, September 3, 1936, at the Post Office, Albany, N. Y., under the Act of March 3, 1879. Volume 37, Number 11.

UNITED AIRPORTS

Division of UNITED AIRCRAFT CORPORATION

use the

SIOUX DUAL-ACTION AIRCRAFT VALVE SEAT GRINDER



Cutaway view showing SIOUX Aircraft Driver, Holder, grinding wheel and Expanding Pilot Stem in position in motor.

For precision accuracy with speed, dependable operation and long service, SIOUX TOOLS meet the exacting requirements of "UNITED", "AMERICAN" and other airports. The modern and handy method of refacing aircraft motor valve seats with accuracy is offered by the SIOUX Dual Action AIRCRAFT VALVE SEAT GRINDER. It can be used on cast, hardened steel, bronze and Stellite valve seats.

The driving spindle is adjustable to any angle. Simply loosen the knurled collar and turn the driving spindle to the required angle. Motor rating 110 v, 7 amp. Universal motor operates on AC or DC. Spindle speed 9,000 RPM, length over all 20½ in., net weight 8½ lbs.

Write for full information

STANDARD THE WORLD OVER

ALBERTSON & CO. INC. SIOUX CITY, IOWA, U. S. A.

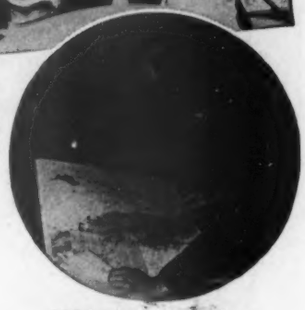
PARKS Offers You Training for Leadership in Aviation Operations

480 hours—air transportation

420 hours—radio communications

20 hours—primary flight training

1123 hours—aviation mechanics



285 hours—meteorology

92 hours—navigation

520 hours—executive subjects

FOR YOU who want a career in the operating and business fields of air transport, the Aviation Operations and Executive Course is recommended.

This course is specialized training for a definite objective—leadership in the operating and business fields of aviation. Every subject offered maintains its place in the curriculum because of its proven value in helping you attain this objective.

The course includes:

285 hours in meteorology
420 hours in radio communications
92 hours in navigation
480 hours in air transportation
1123 hours in aviation mechanics
520 hours in executive subjects
20 hours primary flight training

All of your training is of college and professional school rank. You are acquainted with fundamental principles; also their application in the solution of specific problems. Your hours of training exceed the number required for graduation from the average 4-year curriculum.

Because of the training provided and because of the high standards maintained there is a consistent demand for graduates.

Training that is equally comprehensive is offered in the Professional Flight and Executive Course, the Maintenance Engineering Course and the Aeronautical Engineering Course.

If you want a career in commercial aviation, send for complete information. The coupon will bring you the 60-page catalog and bulletin. They are free.

PARKS AIR COLLEGE

East St. Louis, Illinois

In common with all of commercial aviation this is the code of Parks Air College, "No compromise with safety will ever be permitted or excused."

Fully approved by the Civil Aeronautics Authority. Accredited by the Illinois State Superintendent of Public Instruction.

PARKS AIR COLLEGE
East St. Louis, Illinois Section AV-11

Please send me details of Parks four major courses in commercial aviation training.

Name.....

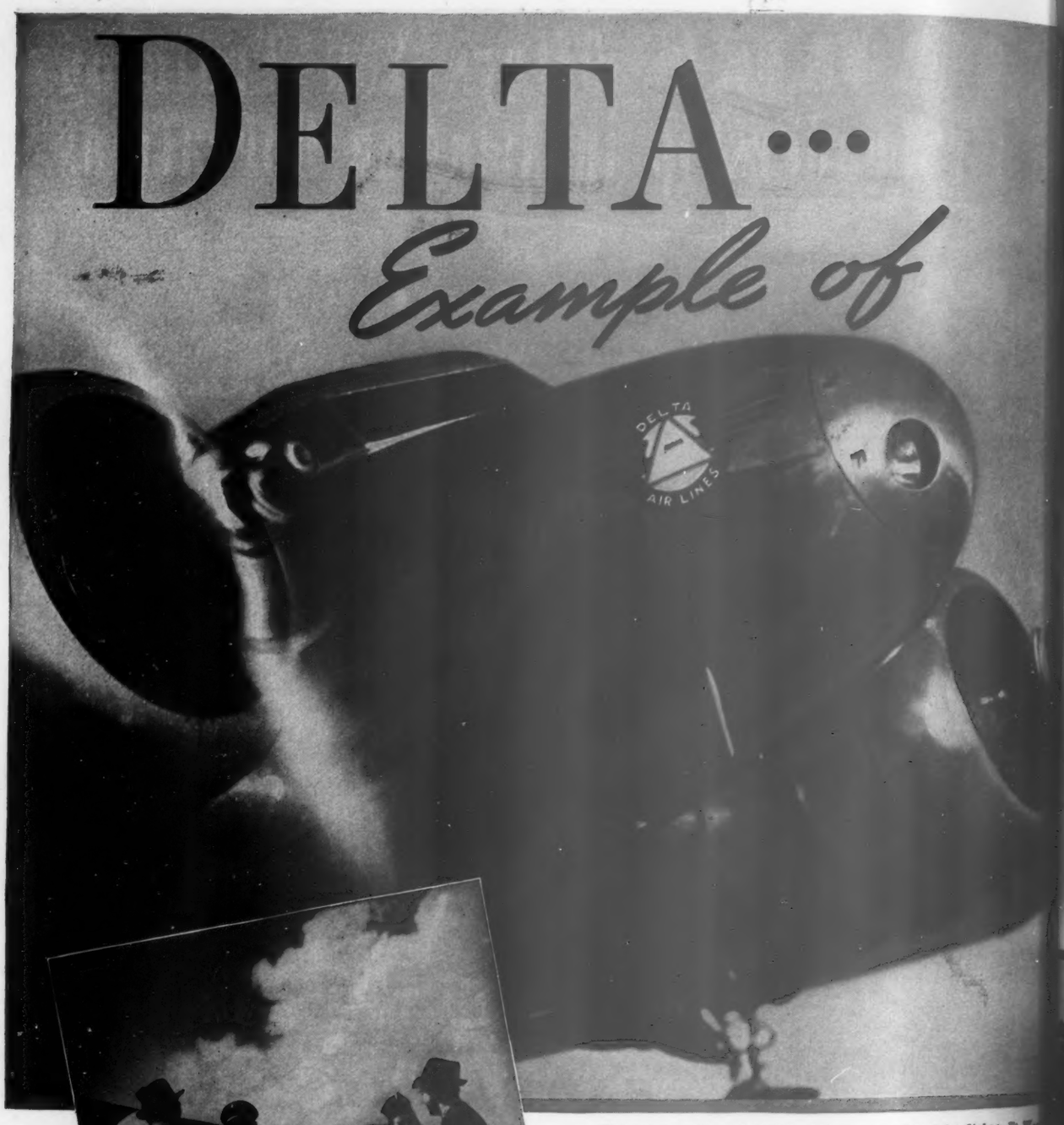
Address..... Age.....

City.....

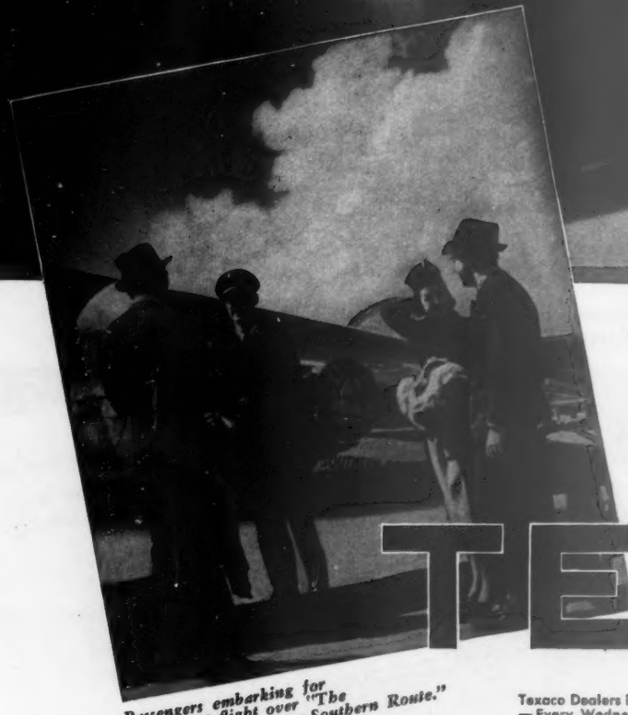
State.....

DELTA...

Example of



10-passenger, all-metal Lockheed Electra warming up for flight to Ft. W



Passengers embarking for fast flight over "The Trans-Southern Route."

TEXACO

TEXACO

Texaco Dealers invite you to tune in The Texaco Star Theatre — a full hour of all-star entertainment — Every Wednesday Night — Columbia Network — 9:30 E.S.T., 8:30 C.S.T., 7:30 M.S.T., 6:30 P.S.T.

Efficiency!

STREAKING BETWEEN CHARLESTON, South Carolina, and Ft. Worth, Texas, the big Lockheed Electras of Delta Air Lines serve the air-minded people of six Southern States.

Back of this trans-southern route is management that achieves high efficiency.

This is exemplified in the way Delta completes such a high percentage of its flights on time, the way Delta keeps pace with the industry, the way Delta avoids troublesome mechanical delays.

Since its inception, Delta Air Lines has used Texaco Aviation Gasoline and Texaco Airplane Oil exclusively.

To get top-flight performance from *your* ships, get in touch with Texaco. You may order Texaco Aviation Products at all important airports. Engineering service is available, and prompt deliveries assured, through 2186 Texaco warehouses.

The Texas Company, *Aviation Division,* 135 East 42nd St., New York City.

Mr. C. E. Faulk
President, Delta Air Lines.

Mr. C. E. Woolman, Vice President and General Manager, Delta Air Lines.

Mr. P. L. Higgins
Operations Manager, Delta Air Lines.

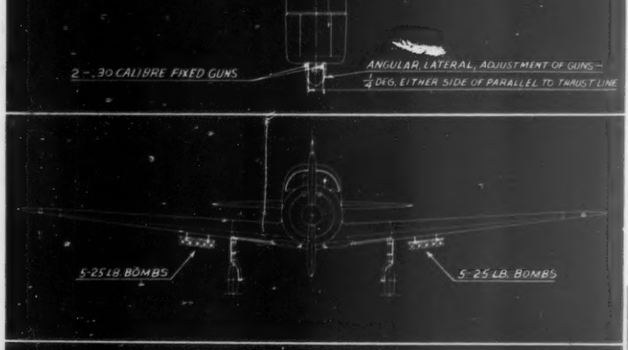
Aviation

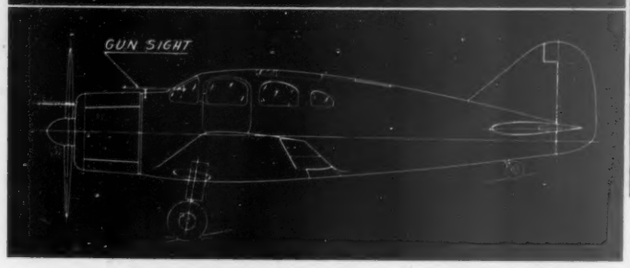
DELTA AIR LINES

FUEL AND LUBRICANTS

Converted To MILITARY FIGHTER

90° FIRING ANGLE
90° FIRING ANGLE
2—.30 CALIBRE FIXED GUNS
ANGULAR, LATERAL, ADJUSTMENT OF GUNS—
¼ DEG. EITHER SIDE OF PARALLEL TO THRUST LINE





The SPARTAN **Executive**—the airplane that today represents THE WORLD'S MOST MODERN TRANSPORTATION is now available in the SPARTAN 7 W-F. A dual purpose plane that can be readily converted from a commercial cabin airplane into an excellent military ship, supplementing an established air force or eliminating the necessity of maintaining fleets of both commercial and military aircraft.

In outward appearance, finish, seating arrangement and in flying qualities, this model is identical to the Standard **Executive,** differing only in armament.

Provision is made in the nose for installation of two .30 calibre fixed machine guns, synchronized with the propeller and firing through the propeller disc. Folding doors and a retractable windshield in the top of the ship provide an opening through which a .30 calibre flexible machine gun may be operated. The gun which is mounted on a removable, hinged post assembly may be stowed inside the ship when not in use. The bottom of the rear seat slides forward providing a gunners platform and gunners seat. In opening the hatch, the doors swing inward locking against the side walls of the cabin. The windshield operates with the doors, raising into position as the doors are lowered. Provision is made on the wings for the attachment of two type A-3 bomb racks.

HIGH SPEED 212 M.P.H. **RANGE 1,000 MILES**
LANDING SPEED 65 M.P.H. **SERVICE CEILING 24,000 ft.**

COMPLETE SPECIFICATIONS, PRICES AND DELIVERY INFORMATION FURNISHED ON REQUEST

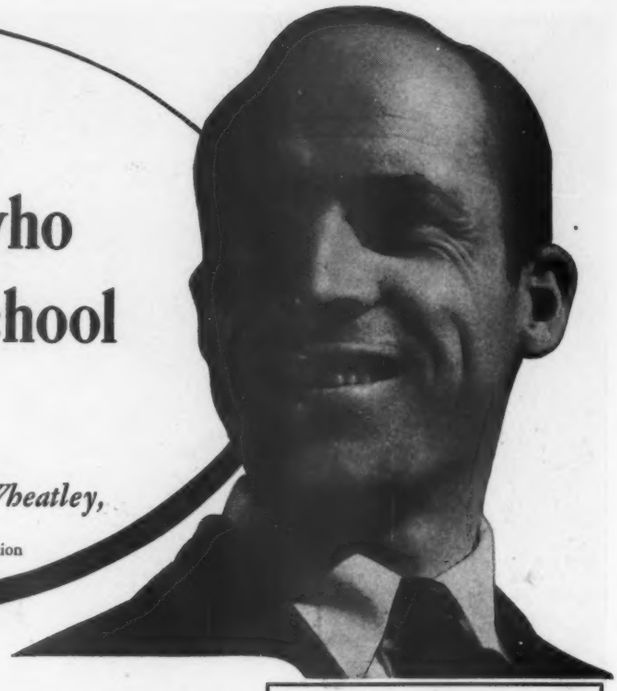
SPARTAN MILITARY ZEUS
Complete Military ALL-METAL Fighter and Bomber

SPARTAN AIRCRAFT COMPANY
TULSA, OKLAHOMA

I have real respect for men who have had Boeing School training

— says William B. Wheatley,

Chief Test Pilot,
Consolidated Aircraft Corporation



It is because the aviation industry needs men trained for careers that Boeing School of Aeronautics exists. United Air Lines founded this school and supervises it closely

WITH your enrollment at Boeing School you step at once into the quick-marching ranks of men whose lifework is aviation. Your aviation career has begun.

For Boeing is more than a school. It is a part of the industry itself. United Air Lines, world's most experienced air transport organization, manages the school expressly to supply young men *trained as the industry wants them trained.*

Boeing School provides an instructor for every 8 students on the average. So instructors here have ample time to go deeply into problems with you.

All Boeing School buildings, directly adjoin United's main West Coast terminal, A-1-A Oakland Airport. Thirteen other airports lie within a radius of 24 miles. In this heart of aviation activities you see every kind of aviation job being handled — come to know industry leaders.

It all adds up to this: Boeing School graduates you with the kind of training that only *an industry supervised* school can give. It is training that records of Boeing School graduates prove to be *career training!*

FREE BOEING SCHOOL BULLETIN tells in full about the school and the Ground, Pilot and Engineering courses offered. Also gives valuable information about duties, qualifications, lines of promotion in all fields of aviation. Mail coupon today for your free copy.

Boeing School of Aeronautics
GRADUATION and PLACEMENT RECORD
(September 1937 — August 1938)

Months	Number Graduated	Number Placements	No. Co.'s Employing Graduates
1937			
Sept.	20	17	7
Oct.	4	3	2
Nov.	2	2	2
Dec.	29	7	3
1938			
Jan.	7	14	6
Feb.	1	9	7
Mar.	40	16	6
Apr.	6	13	3
May	6	12	6
June	30	5	4
July	4	8	4
Aug.	2	3	3
TOTAL	151	109	27

Students ready to test Radial Motor after complete overhaul in Engines Shop—Boeing School's "Airline Technician" course

Boeing School of Aeronautics

A division of UNITED AIR LINES

U. S. Government approved in ALL departments—Private and Commercial Flying, Mechanic Training, and Repair Station

A COMPLETE RANGE OF CAREER COURSES

There's one specially designed to provide a thorough foundation for success in *your* chosen field of aviation

Check the course or courses you're most interested in:

Courses requiring high school only:
- ☐ Commercial *(or)* L. C. Pilot
- ☐ Private *(or)* Solo Pilot
- ☐ Airline Operations
- ☐ Airline Mechanic
- ☐ Aircraft Sheet Metal

Courses requiring 2 yrs. pre-eng.:
- ☐ Air Transport Engineering
- ☐ Airline Flight Officer

Courses for engineering graduates only:
- ☐ Airline Technician
- ☐ Dispatching and Meteorology

Courses requiring special training:
- ☐ Special Airline Pilot
- ☐ Instrument Rating

NOTE: Link Trainer instruction available to students in all courses.

Boeing School of Aeronautics,
Dept. T-35, Airport,
Oakland, California.

GENTLEMEN: Please mail me—without charge—the BOEING SCHOOL BULLETIN containing complete information on the school and courses I have checked at the left.

Name _____

Address _____

City _____

State _____ *Age* _____

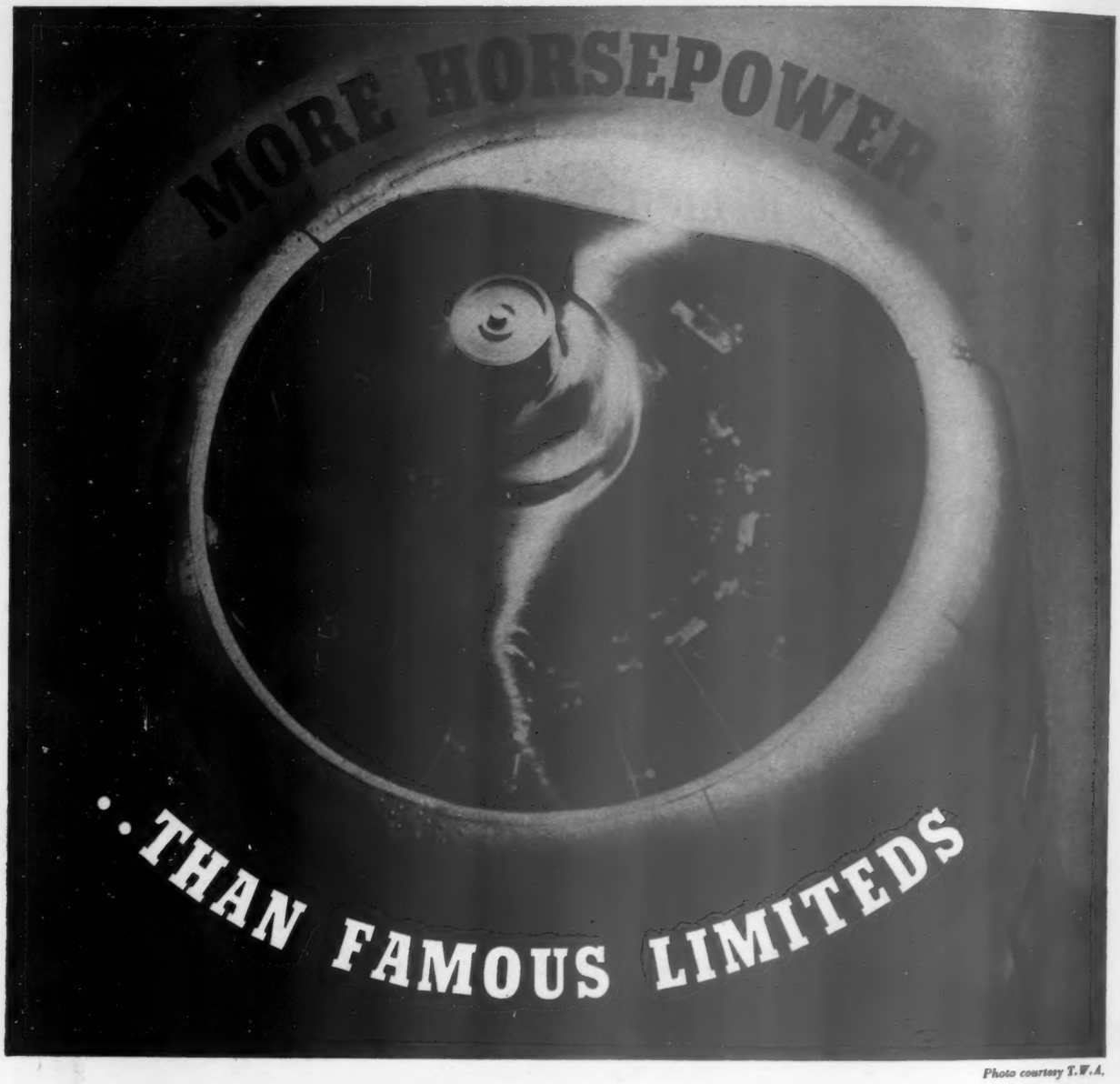


Photo courtesy T.W.A.

NEW TRANSPORTS race ahead with five to six thousand horsepower—a third more than streamlined trains such as the Century or the Chief. To safely harness this higher power, aircraft engineers and metallurgists have greatly increased the abilities of materials of construction.

Nickel strengthens and toughens metals, makes each ounce carry more load and wear longer. Rods and guides and roller bearings, made amazingly strong with Nickel alloy steels. From OX5's and Liberty's to today's 1500 HP units, Nickel has served practically every engine builder in this country and abroad.

• • •

Have you noticed the widespread discussion about wing and fuselage construction using especially processed chromium-Nickel stainless steels? New fabrication methods produce a rivet-free surface on this high strength-weight ratio material —with its known resistance to corrosion. Your inquiries regarding uses of Nickel are invited.

ALLOY NICKEL STEELS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N.Y.

THE
OLDEST AMERICAN
AERONAUTICAL MAGAZINE

AVIATION

Established 1916 . . . . . .
McGraw-Hill Publishing Company, Inc.

Louis F. Stoll
Vice-President

S. Paul Johnston
Editor

•

Leslie E. Neville
Managing Editor

Daniel Sayre
Associate Editor

Donald G. Fink
Radio Editor

Charles F. McReynolds
Pacific Coast

Paul Wooton
Chief of Washington Bureau

McGraw-Hill Publishing Company, Inc.
James H. McGraw
Founder and Honorary Chairman
Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York, N. Y.

Chicago, 520 North Michigan Ave.
San Francisco, 883 Mission St.
Los Angeles, 9121 Dalton Ave.
Aldwych House, Aldwych, London, W. C. 2
Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

James H. McGraw, Jr.
President

Howard Ehrlich
Executive Vice-President

Mason Britton
Vice-Chairman

B. R. Putnam
Treasurer

D. C. McGraw
Secretary

A. W. Morrison
Circulation Manager

Published monthly, price 35c a copy. Subscription rates—United States, Canada, and Latin American republics, $3.00 a year. All other countries, $5.00 a year or 20 shillings. Entered as second-class matter, September 3, 1936, at the Post Office, Albany, N. Y., under the act of March 3, 1873. Printed in U. S. A. Cable address "McGrawhill, New York." Member of A.B.C. Copyright 1938 by McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York, N. Y. The following publications are combined with AVIATION: AERONAUTICAL ENGINEERING, AIRCRAFT JOURNAL and THE AVIATION NEWS. All rights to above names are reserved by the McGraw-Hill Publishing Company.

Production Hawker Hurricane (Rolls Royce, 1030 hp.)

Contents for Vol. 37, No. 11

NOVEMBER 1938

REGULAR EDITION

Flashes—L'Aviation International 13
From the Skyways of the World

Side Slips *By Robert R. Osborn* 17

Frontispiece 18
Blackout

Editorials 19
For National Safety; Overseas Again

Our Air Defense Problem *By Hanson W. Baldwin* 20
America's Air Strategy in the Light of the Base Problem

Our Air Defense, Part I, The Army *By Daniel Sayre* 22
To Strike and To Strike Hard are Air Corps Objectives

Our Air Defense, Part II, The Navy *By S. Paul Johnston* 26
Far Flung Frontiers Focus Attention on Long Range Patrol Problems

Directory of Military Airplanes and Engines 30
Specifications and Photographs

Engines Used in the Airplanes in this Directory 42
Tabular Specifications of Military Engines

Flying Equipment 43
Vega Monoplane 43
Taylor-Young 50 44
Military Norseman 45
Conn Retractable Wing Monoplane 45

Aviation Radio *By Don Fink* 48
United-Western Electric Absolute Altimeter, Sperry-R.C.A. Direction Finder

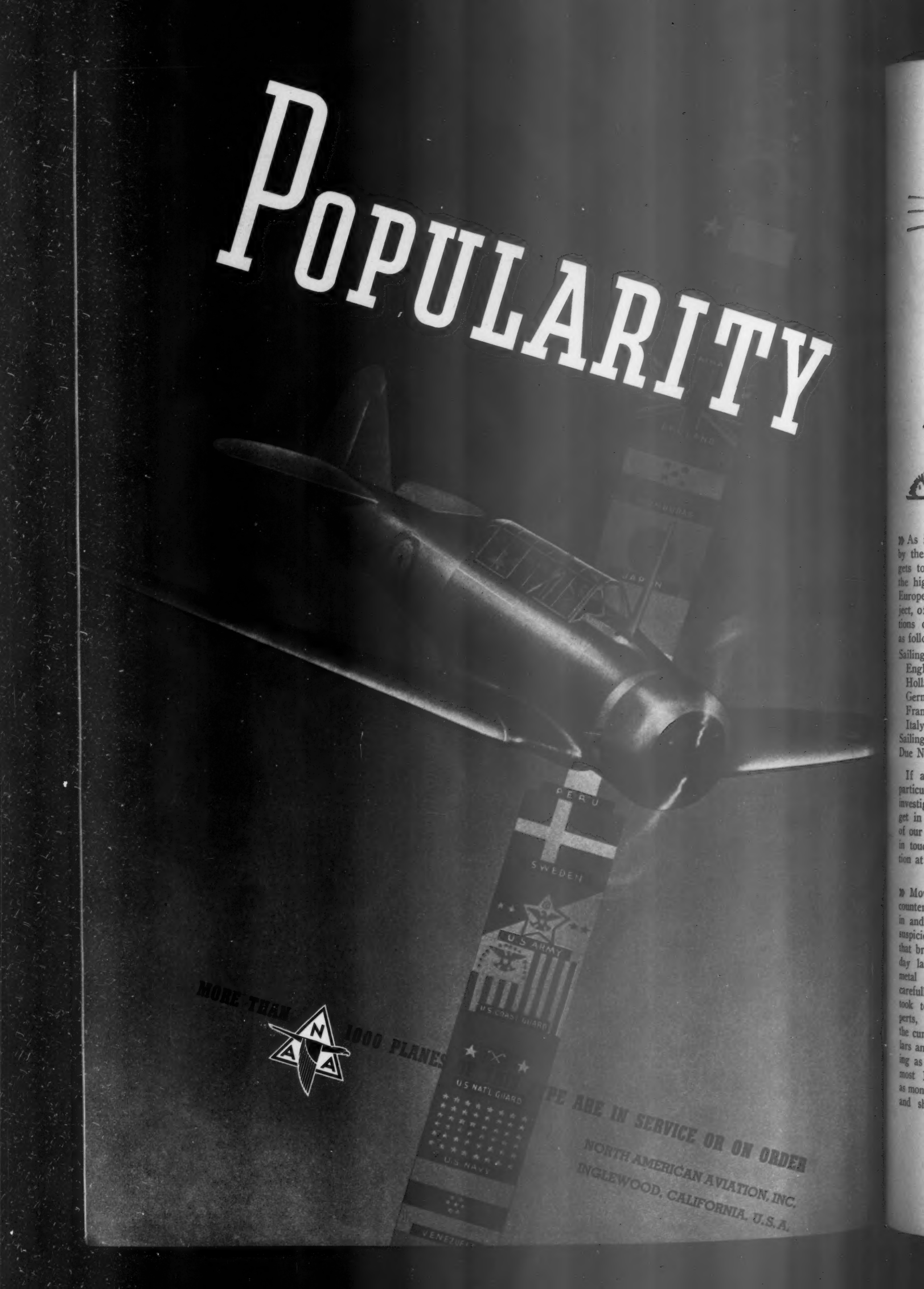
Buyers Log Book 50
A Review of New Equipment for the Industry

The Aviation News 53
Spot Landings on the Month's News 54
Safety Scores Gains on Wide Front 55
Aviation in Washington 56
As Others Fly It 61
Logging the Lines 62
Aviation People 63

Operators Corner 65
Tagging the Bases with Les Neville

A McGRAW-HILL PUBLICATION

POPULARITY


PERU
SWEDEN
U.S. ARMY
U.S. COAST GUARD
U.S. NAT'L GUARD
U.S. NAVY
MORE THAN 1000 PLANES
E ARE IN SERVICE OR ON ORDER
NORTH AMERICAN AVIATION, INC.
INGLEWOOD, CALIFORNIA, U.S.A.

Flashes

From the Skyways of the World

» As indicated on the editorial page, by the time this issue of AVIATION gets to press, your editor will be on the high seas, headed once more for Europe. The general program, subject, of course, to changes that conditions over there may necessitate, is as follows:

Sailing, Oct. 22, SS "Champlain"
England, Oct. 30 to Nov. 10
Holland, Nov. 11 and 12
Germany, Nov. 13 to Nov. 19
France, Nov. 20 to Nov. 26
Italy, Nov. 27 to Dec. 3
Sailing, Dec. 4, SS "Rex"
Due New York, Dec. 10.

If any of you readers have any particular things that you would like investigated, would suggest that you get in touch with Miss E. J. Rose, of our New York office, who will be in touch with the European expedition at all times.

» MOVIE HOUSE CASHIERS, cigar counter, men, and streetcar conductors in and around Newark viewed with suspicion a rash of strange coinage that broke out all over the place one day last week. They weighed the metal disks in their hands, looked carefully on both sides, and a few took tentative bites. Financial experts, with little difficulty, identified the curious tokens as U.S. silver dollars and every bit as good for spending as the familiar dirty greenbacks most Easterners recognize instantly as money. Investigators went to work and shortly reported that all were traceable to the employees of American Airlines at Newark airport. Further research disclosed the fact that all AA personnel had been paid a cash bonus (in silver dollars) of $25.00 each for extra services performed during the period of emergency caused by the tropical hurricane that swept into New England.

For the boys on the Eastern division had really done themselves proud. During the three days following the storm there was scarcely a minute all day when the AA Flagships were not wheeling in and out of the station, shuttling back and forth across the stricken areas. Boston and other points were cut off from all communications except by air. When the score was added up some astounding totals developed: 10,000 passengers and 400,000 pounds of equipment, money and supplies transported into Boston in a 9-day period. Hundreds of people flew on emergency business that had never set foot in an airplane before. Thousands had reason to be thankful for air transport who had never had contact with the industry except through the Sunday supplements.

» NOTEWORTHY ALSO, the splendid cooperative job by all the airlines in the emergency. Demands quickly exceeded AA's capacity in men and machines, so the other lines in the East instantly stepped into the breach. Every available ship and pilot on Eastern Air Lines, TWA, and United was detailed to American's Newark-Boston run. Ships were dispatched as available without regard to the marking on their wings. Pilots and ground personnel labored mightily in the common cause and turned in a performance for safety and dispatch that will stand for a long time. All aviation may well be proud of the job they did.

WHAT'S IN THIS ISSUE

Herewith our long planned National Air Defense Issue, a study of what our air defense problem is, and what we are doing about it. . . . Hanson W. Baldwin, who wrote our introductory article on American defense strategy, is a member of the staff of the *New York Times*, an outstanding writer on military affairs. Mr. Baldwin is a graduate of the U.S. Naval Academy, and for the past ten years has followed military developments here and abroad for the *Times*. He speaks as an authority in his field. . . . The story of the Air Corps and the story of naval aviation were put together by members of the staff, in close cooperation with the two services. It is obviously impossible to cover the details of military or naval aviation exhaustively short of a book apiece, but we present these two studies which point out the outstanding problems that face each of the two services and the methods they are employing to meet them. . . . Follows a directory of the military equipment manufactured in this country, both for our own service and for export. . . . Most important radio developments of the month were the United-Western Electric absolute altimeter, and the Sperry-RCA DF. Details of these two projects are covered both in our radio department and in the News.

An Ear to the Ground

A FINGER ON THE PULSE OF FOREIGN MARKETS —A KNOWLEDGE OF WHAT'S NEW AND BEST IN AERONAUTICAL DEVELOPMENT—A POLICY OF REPRESENTING ONLY THE FINEST PRODUCTS OF THE LEADING AMERICAN MANUFACTURERS —ALL THIS HAS SERVED TO MAKE

The INTERCONTINENT CORPORATION

The Leading Exporters of Aircraft and Aeronautical Products in the World

●

30 ROCKEFELLER PLAZA, NEW YORK CITY, U.S.A.

CABLE ADDRESS: INTERAERO, NEW YORK

» AND A FINE SENDOFF it was for Air Travel Week. It focused attention on the advantages of transport by air more dramatically than the prearranged programs that followed. The latter were, however, generally well worth while. Special flights, broadcasts, luncheons, etc., all did an affective job in improving our public relations. We hope that it will all be reflected in an increase in seat sales over the next months.

» NEW YORK had a spectacular show on the opening day. Led by the Bermuda Clipper (with Mayor LaGuardia and the members of the CAA on board), seventeen DC-3s flew in single file up and down Manhattan at lunch hour. If there has ever been a greater concentration of big transports on parade, we have never heard of it. All the lines that had ships available in the area participated. The National Broadcasting people had an outfit on board one of the ships and interviewed some of the guest passengers on a national hook-up during the flight. Rear file of the parade (at 5,000 ft.) was O. J. Whitney in a twin-Beech, a transport in the modern manner in miniature.

» MOST ELABORATE, perhaps, of the week's luncheons in the New York district was that put on by the Advertising Executives' Club in the Hotel Roosevelt Ballroom. EAL's Eddie Rickenbacker acted as toastmaster, introduced a notable list of aviation speakers including Jacquelin Cochran, Casey Jones, T. P. Wright, Roscoe Turner, and a number of others. Some thirty-odd aviation-people-about-town sat at the twin-row speaker's table.

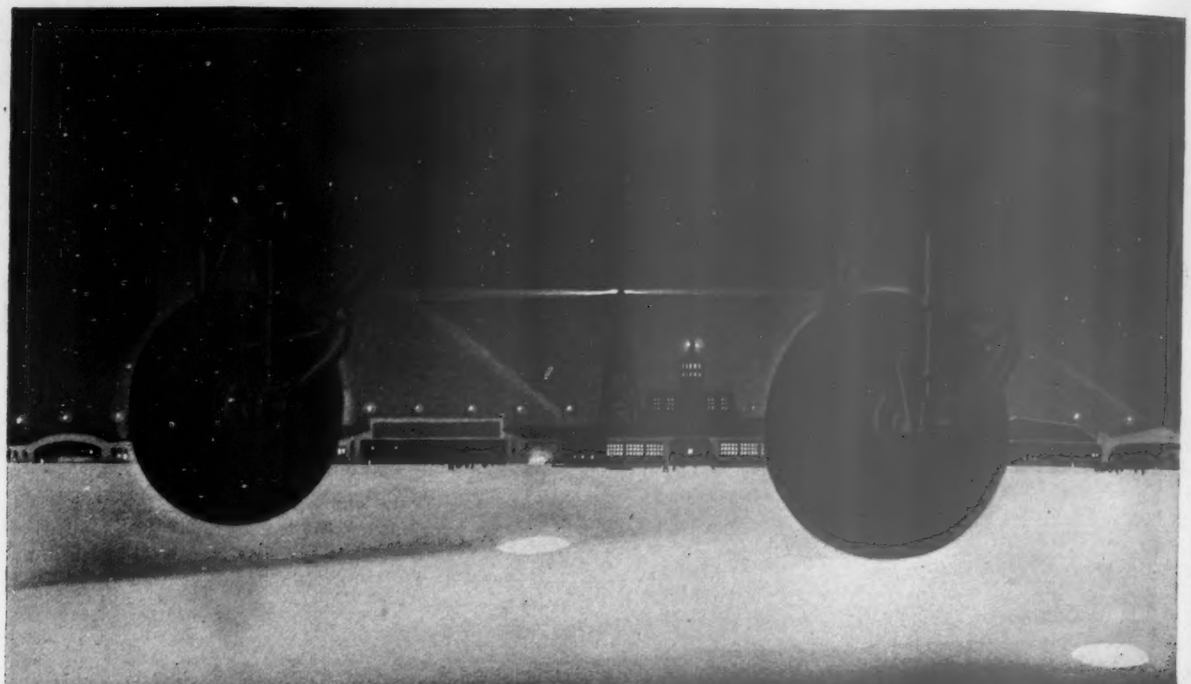
» WE'D LIKE TO TAKE THIS OPPORTUNITY to express our thanks for the very high degree of cooperation given us on this issue by the Service people in Washington. On the Air Corps story, the late General Oscar Westover made many valuable suggestions in the early stages of the discussion, and Lt. Col. Ira Eaker and Col. H. H. C. Richards were extremely helpful in working out the details. For the Navy: Admiral Cook and his assistant, Captain Jack Towers, made themselves available for discussion of the general plan, and Commander R. O. Davison was most generous of his time on details. And a very special orchid to Joy Bright Hancock of the Bureau of Aeronautics for her many suggestions on the text and for her never failing help in and around the Bureau.

"Maguire just transferred from observation to pursuit!"

» BY THE WAY, Joy Hancock is a brand new author in her own right, having just published a little book called "Airplanes in Action." If you have a boy (or a girl, for that matter) who is interested in having a primer of service and commercial aviation, you ought to have a copy. Whittman of Racine, Wis., is the publisher; Woolworth is the distributor.

» AND SPEAKING of Women-in-Aviation as authors, two new and worthwhile books have been added to the lists this month. "High, Wide and Frightened" (Stackpole Sons, N. Y.) is Louise Thaden's first excursion into print (in book form) and throughout it is as interesting as its title is clever. It is her own story, and is told as informally as though she were sitting down with you over a couple of beers. Louise has been intimately and valuably connected with this industry for a long time, and her many friends will welcome having her own account of her work.

» ANNE MORROW LINDBERGH has again written a beautiful book (Listen! the Wind. Harcourt, Brace & Co., N. Y.). Her story of the flight of the "Tingmissartoq" from Africa to Natal in December, 1933, is notable not only for the suspense that is sustained (despite the reader's knowledge of the flight's safe completion), but for the beauty of its prose. The modesty and reticence with which she tells her story does not conceal the fact that Anne Lindbergh's tact, her courage, and her competent handling of the job of radio operator and copilot play no small part in her husband's successful flights. For aviation people, chief interest attaches to the painstaking account of unexpected difficulties met and overcome, the maps by Col. Lindbergh and his appendix of the plane's equipment. The lay reader will glimpse the hazards and the tireless attention to detail that underlie the drama of long-range flights. But for all readers, the sensitive and poetic writing of Mrs. Lindbergh will be sheer delight.



"A man's judgement is as good as his information"

IN the design of aircraft landing-gear, the well-founded axiom that a man's judgement is as good as his information, expresses the whole situation.

Bendix, cheerfully accepting any part or all of the responsibility for designing and manufacturing landing-gear for any aircraft, draws upon a really vast fund of data and experience in this specialized phase of aeronautical engineering. As a supplement—a reinforcement—to the research of your own engineering staff, this can be most valuable. And when the manufacturing stage is reached, Bendix facilities, which range from close metallurgical control to precision testing routine, available nowhere else, provide a solid basis for *responsibility*.

You can confidently entrust that responsibility to Bendix.

BENDIX PRODUCTS DIVISION
OF BENDIX AVIATION CORPORATION · SOUTH BEND, INDIANA

BENDIX

AIRPLANE WHEELS · BRAKES · PILOT SEATS · PNEUDRAULIC SHOCK STRUTS

Side Slips

By
ROBERT OSBORN

» "FORT MCCLELLAN, ALA., Oct. 2 (United Press). The first tests of a cotton-paved airport—which may open a vast new market for Dixie's chief crop—were completed tonight, but officials made no comment. All day long the army's planes landed on the

runways at Reilly Field here attempting to prove the worth of the asphalt and cotton combination."

In 1931, after a tour of the country, Fowler Barker reported that the most pressing need of aviation was a method of growing cotton on paved runways. Now it seems that the most pressing need for agriculture is a method of paving runways with cotton, proving that history can repeat —in reverse.

» THAT TREMENDOUS SIGH OF RELIEF you heard about October first was from those aircraft manufacturers with all the foreign orders half-built in their factories. There's always something to make life miserable for the poor manufacturer—just when he succeeded in chasing the wolf and the sheriff away from his door, the Neutrality Act starts making him walk the floor nights.

» WE WERE FAR LESS SURPRISED than most people when European affairs were settled peacefully, at least temporarily, by the conference of four powers. After reading that the heads of this country's air lines had conferred and reached agreements on elimination of speed competition, more conservative weather limitations, and other important subjects, we knew that the settlement of the European difficulties would be relatively easy.

» HOWEVER, there's one privilege we felt sure the air lines will never give up—that of printing maps showing their particular route as a straight line all of the way across the country, with large cities moved hundreds of miles out of position so they'll be on that all-important straight line. Perhaps it is just as well they continue this map-warping practice, as it has years of traditional background with the railroads and probably goes all the way back to the pony express.

» WE SEE by the papers that the Post Office Department has opened bids on two experimental rural pick-up air-mail routes, with specially-built planes dropping off and picking up the mail bags without stopping, in much the same manner as the railroads have been doing.

This news brings back fond memories of our youth, when the high spot of the day for the boys of our town was the delivery and pick-up of the mail by the "Cannon Ball" express. It was particularly interesting for use because the mail clerk had a grudge against the station agent and each day tried to "bean" him with the mail bag.

» IN CASE any of you fellows get lost on cross-country, you might make note of the fact that a Soviet aviator reports smooth landing fields on the ice floes within 450 miles of the North Pole.

» THE AIR CORPS OF SEVERAL FOREIGN GOVERNMENTS are now reported to have *training* planes with a three hundred m.p.h. top speed. We'll bet that the war-time training planes would never recognize their grandchildren.

Perhaps we are just an old sentimentalist or something, but we think that designers of training planes should never have given up the practice, started with the famous "Jennies," of having holes for a couple of non-existent instruments in the instrument board. The holes were perfect places for the pilot to stuff his gloves, set up his pack of cigarettes, and hang up the speaking tube. They also enabled him to stick his chewing gum on the back of the instrument board instead of on the front where it would be unsightly.

» Speaking of training planes, we notice frequent items in the local newspapers about students who solo "after only three hours of flying instruction."

Pilots who received their flight training during the war or in the early days are probably curious as to what the students were taught in the other two hours.

» THE INTREPID AVIATOR was relaxing within reach of our box of cigars the other day. In the course of our discussion he commented on the new blind-landing device which consists of a frosted glass screen with a speck of light moving across it. He thought that the invention might be excellent but the mechanism was an unfortunate choice, in his opinion, as he per-

sonally had gotten into plenty of trouble because of specks of light associated with frosted glass—in swinging doors.

» "ON FOUR ENGINEERS, during saw-tooth climbs, the plane rose above 25,000 feet with a full load. On three engineers, in similar tests, the plane reached a ceiling of 20,000 feet."—(Newspaper report of Douglas DC-4 flight test.)

Damn husky—those California engineers

Courtesy U. S. Army Air Corps

FOR NATIONAL SAFETY

FOR THREE DAYS the world looked straight into the mouth of hell. Incredibly swift, crisis piled upon crisis until it seemed utterly impossible that the dogs of war could be kept in leash. Cities were evacuated, sandbags piled high around public buildings, big guns rumbled through the streets of Europe's capitals. Only by the narrowest of margins did diplomatic efforts succeed in curbing forces that seemed bent on destruction.

Although we here in America are still in a strategically fortunate situation behind our ocean barriers, we must not let ourselves be lulled into a false sense of security. No urgent need to enter into any unbridled armament race with the rest of the world, but with conditions as they are, we must analyze our defense problem critically and lose no time in building up whatever land, sea and air forces we need for national safety.

With that in mind, therefore, AVIATION this month devotes a large share of its contents to a study of our national defense problems with particular reference to our air arms. We have tried to show what the problem is and what is being done about it. We present our findings with mixed emotion. With pride we point to the outstanding technical accomplishments of our Air Corps and our Naval Aviation. With alarm, however, we view the fact that our effective air strength is lagging far behind that of other powers in a world where armed might prevails.

Now, we in America must begin thinking in terms of mass production for aircraft and forget about turning them out a few dozen at a time. Equally important, we must overhaul our training programs and find some workable means of matching our potential production of machines with men fit to fly them. Whether we like it or not, the rest of the world is on a wartime footing and our hand has been forced. Any further delay in building our aviation up to the minimum required for national safety would be foolish beyond belief,—a deliberate courting of ultimate disaster.

OVERSEAS AGAIN

AVIATION has always considered its interests international. In keeping with that idea its editors have made a practice of making a personal survey of conditions in Europe on an average of once every two years for the past decade. Continuing our policy of first-hand coverage of world events, your editor is temporarily abandoning his New York desk for another close-up look at aviation abroad. In the next few issues, therefore, we hope to bring back to our readers in America a fresh slant on current events on the European aeronautical fronts.

"Black-out"

OUR AIR DEFENSE

By

Hanson W. Baldwin

Military Feature Writer, New York Times

"LACK OF STRATEGIC IDEAS, too much attention paid to technical achievements" is the way that Golovine (a Russian military analyst) describes an outstanding weakness of the military air services of the United States. Perhaps America has never had its Golovine, its Charlton, its Douhet, but out of the welter of conflicting ideas of the past decade, out of unfortunate differences of opinion between individuals of the Army and the Naval air services, may at last begin to emerge an American doctrine of aerial defense, the tactics of tomorrow.

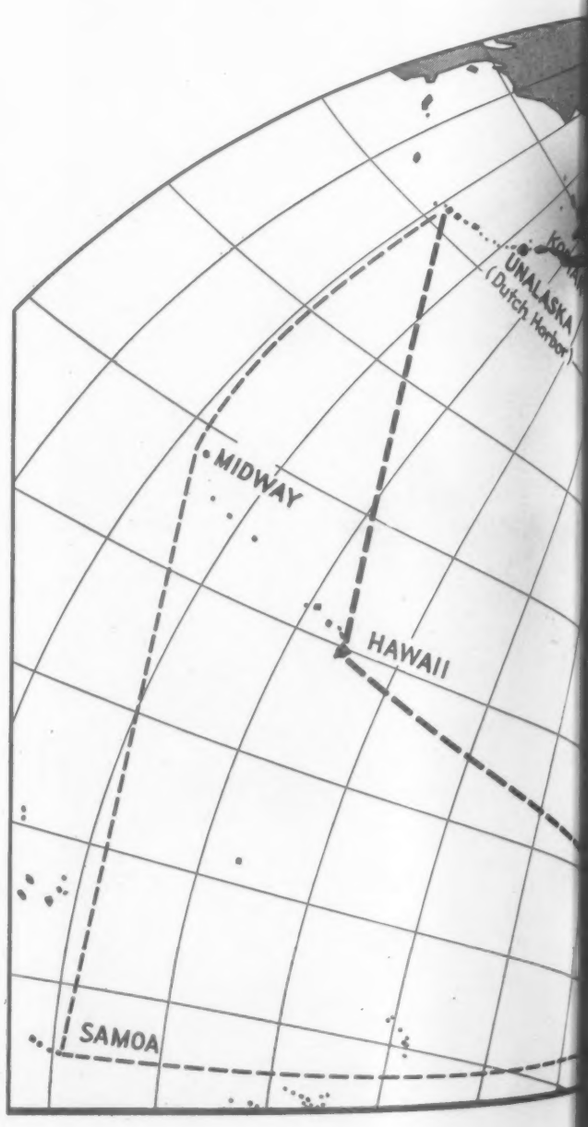
The air defense of America and its possessions must be built around a strategy based on harmonious cooperation of the military air service with the navy's flying fleet, and in turn upon the cooperation of both with ground and sea forces. For it might as well be said at once that there is nothing in past, or present flying experience to support a belief that the air arm can replace the sea, and/or, ground arms. In none of the missions of defense is the air army of today—or even of the foreseeable tomorrow—qualified to act alone. On the contrary, neither the army nor the navy can fight today with any real hope of success without the full and whole-hearted support of their air forces. More than ever before in the long history of warfare the combat team today must be coordinated; the three services of land, sea and air, must, like D'Artagnan's musketeers, be "one for all, and all for one".

Since the air arm has made itself so much a part of the combat team in modern war the air arm must be employed —or at least available for employment—in nearly any major situation calling for the application of military force of any kind. Hence America's air armies will *share* responsibility for:

1. Defense of the continental coasts of the United States in particular, and the entire country in general. This includes the defense of cities against air attack, the defense of strategic centres, the protection of docks, bridges, power plants, factories, etc.
2. The defense of the Panama Canal.
3. The defense of the Alaska and the Aleutians.
4. The defense of the Hawaiian Islands.
5. The defense of American island possessions in the Caribbean and Pacific.
6. The protection of our coast-wise and overseas commerce.
7. The implementation of American foreign policies, including (possibly) protection of our nationals and our interests overseas.

In considering the question of our air defenses we must, insofar as it is possible, project ourselves into the future to that day when the oceans will no longer be the ramparts to invasion they now are. The average radii of action for the world's bombers today (flying in mass flight, with bomb loads for large-scale attack, and sufficient fuel for round trip from base to objective and return) probably does not exceed 600 to 700 miles. Thus today's base problem is relatively simple, since mass continuous bombing from the air is now impossible against America's strategic centres or vital interests. But such bombing will be possible tomorrow, although when that day comes our aerial defense problem will be complicated but not fundamentally changed, assuming, of course, that we maintain our aerial defending forces with a radii of action at least equal to that of the enemy and with a strength as great.

For when the world has narrowed so that all powers are within bombing range of each other and there are no longer any "air frontiers," the only defense against bombing will be retaliation, swift and implacable, against the enemy's air bases, his strategic centers, his reserves of



PROBLEM

A study of America's defensive strategy, with particular reference to air bases.

power and strength. And when that day comes any advance or outflung bases that we may now establish in order to protect our continent during aviation's foreseeable tomorrow will be—if not too exposed to enemy action—advance bases which, if they no longer deny the enemy the ability to bomb America, will at least permit us with far greater facility to bomb the enemy.

With these premises in mind let us investigate the specific strategic problems confronting us.

1. Defense of the United States

The continental United States is peculiarly invulnerable, because of its favorable strategic location behind the bastions of ocean, from all forms of military attack. It has no real Achilles heel; no one small or restricted area of the nation is absolutely vital to the rest of the nation; the county could stand considerable amputation of its various parts without being forced to capitulation. However there are certain highly important strategic regions; these, in the approximate order of their importance are:

The Pittsburgh-Chicago-Detroit industrial triangle.

The New York-Philadelphia-Delaware Capes industrial, shipping, warehousing, docking and financial center.

The oil fields, oil storage facilities, docks, plane factories and shipping of the San Pedro-San Diego (California) area.

The plane and munition factories and closely-concentrated industries of the New England area; Boston shipping and wharfage facilities and the power and industrial areas of Northern New York State.

The Chesapeake Bay Area—deep sea waterway to army and naval bases, docks, airfields of the Norfolk area, to the industries of Baltimore and to the political capital of the nation, Washington.

New Orleans, the Gulf Coast and the Mississippi—gateway to the riches of the south and southwest.

The Puget Sound area—docks, water power and timber.

Other areas of the country, although perhaps less important strategically, nevertheless require protection if for no other reason than to prevent any enemy from using them as bases for operations against the richer and more important sections.

Main base areas, therefore, should be so placed as best to protect these important areas. Our tendency today perhaps, is to concentrate too many planes at a single base; a large main base is necessary, but we should study the European method of dispersing planes at numerous small bases rather than concentrating them at one large base. Throughout this discussion whenever the term "base" is used it is meant in the European sense—as a base area comprising a number of small bases—too dispersed to present a concentrated target to bombers, but close enough to permit rapid concentration of the air forces in this base area. Where the term "auxiliary base" is used, a single small airfield or sea-plane anchorage equipped to hangar or moor no more than a squadron of planes is meant.

With this in mind look at the map accompanying this article and see how the cordon of bases itemized can be utilized; (1) today, to deny to any enemy the ability to launch serious, continuous mass air attacks against the continental United States; (2) in the future, to serve as advanced bases from which operations against the enemy can be more readily conducted.

The West Indian base, located preferably in Porto Rico (a large island, with good harbor and anchorage facilities, easily supplied and backed up from the United States),

(*Turn to page 68*)

OUR AIR DEFENSES—I

The ARMY

To strike and to strike hard are Air Corps' major objectives. We have the most efficient fighting aircraft in the world, but we need more of them. Mass production of machines and pilots must be our next concern.

By Daniel Sayre

Associate Editor, Aviation

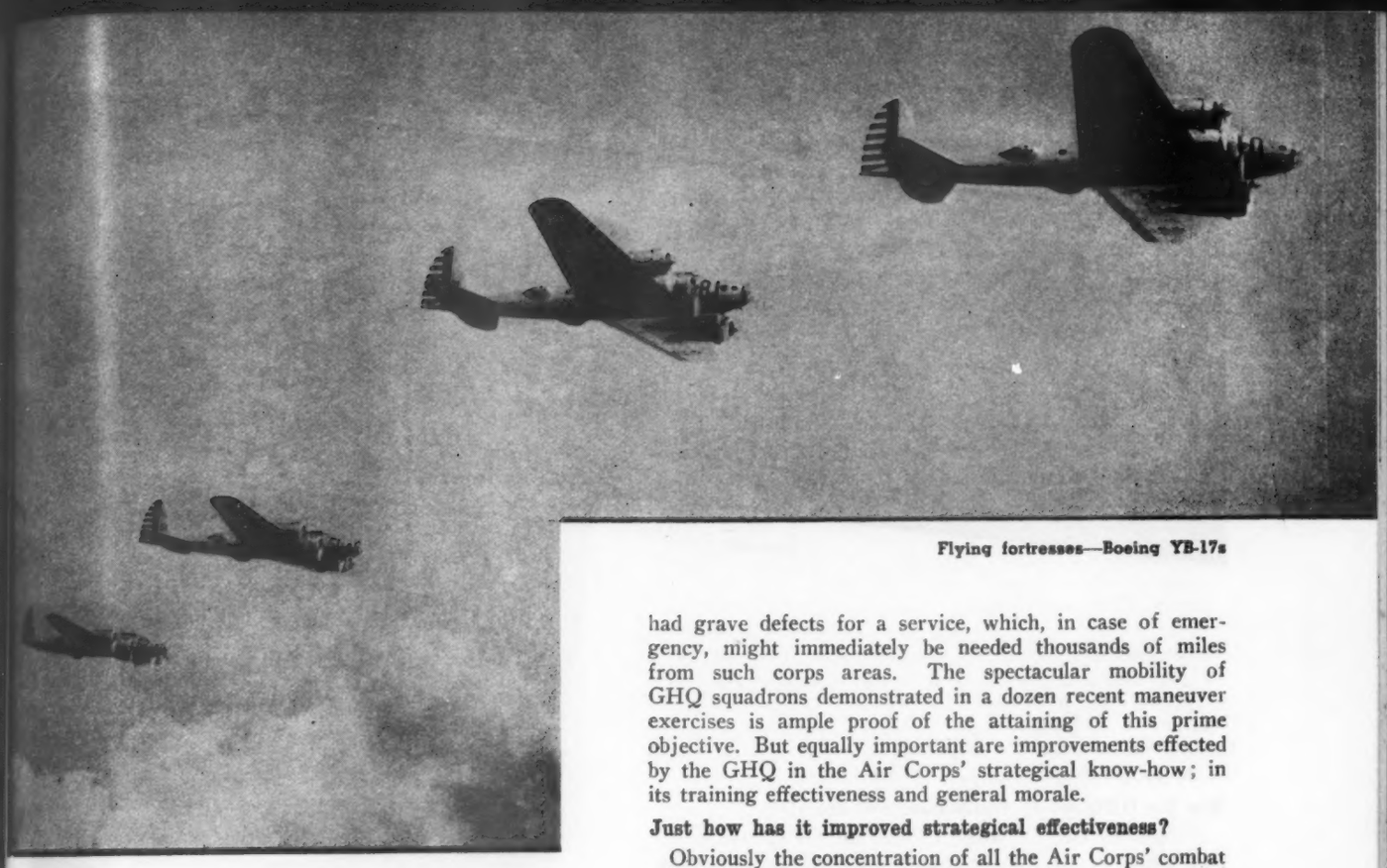
Douglas B-18s

THE STORY of our modern Army Air Corps is—in its main elements scarcely more than three years long. In 1935, remember, the Air Corps completely changed its organization and practically changed its aim in life by setting up the General Headquarters Air Force. That same year: Congress passed the Wilcox bill calling for a modernized plan of air bases for defense. The Air Corps started operating under a new method of procurement designed to eliminate negotiation of production contracts. Its appropriations for new equipment, after a five-year period of undoubted inadequacy, began climbing toward more reasonable levels. Finally, by 1935 the revolution in military aircraft (begun by the first Martin high-speed bombers) was in complete control. With concepts of speed, range and striking power suddenly doubled, it would hardly be too much to say that even if the Air Corps had been a thing-perfected it would have had to be recast into a brand new mold anyway.

This story, then, is one of intense work, of rapid changes, of large-scale military pioneering rarely matched in peace-time history. To summarize its background, recount its trials and triumphs and sound off about its future would take a book. Here we must be satisfied with the high-lights. It seemed to us we best could bring those out by leaving the story in the form in which it was gathered—as the best answers we could assemble to the most leading questions we could think of. As follows—

Many times before 1935 and occasionally since, air defense enthusiasts have claimed the Army does not attach sufficient importance to the Air Corps. Is there any present basis for this criticism?

If there is, it is marvelously hard to back up with evidence. In 1926 the Army used 12.7 per cent of its total funds for its air arm. In 1938 it was spending no less than 28.9 per cent; and the ratio is still climbing. In absolute figures, the air arm had a total of $44,300,000 for all expenses, including procurement in 1926; in 1938



Flying fortresses—Boeing YB-17s

it had $127,246,873. In addition to that soundest of all indexes, War Department action in setting up the GHQ and in generous expenditures on Air Corps bases (not included in the above figures) are further proof of a current deep air-mindedness.

How has the General Headquarters Air Force idea worked out?

Right up to the rosiest of expectations. Before 1935, control of the Army's air strength was dispersed throughout nine separate corps areas. Obviously such a situation had grave defects for a service, which, in case of emergency, might immediately be needed thousands of miles from such corps areas. The spectacular mobility of GHQ squadrons demonstrated in a dozen recent maneuver exercises is ample proof of the attaining of this prime objective. But equally important are improvements effected by the GHQ in the Air Corps' strategical know-how; in its training effectiveness and general morale.

Just how has it improved strategical effectiveness?

Obviously the concentration of all the Air Corps' combat strength into a single unified command, in itself opens up a wide range of strategical operations which would be well nigh impossible under the old diversified command organization. But the possession of such a force in peacetime has already proved of great educational value, not only to the General Staff and the top officers of the Corps, but to the entire commissioned personnel of the air arm. Compare pre-1935 maneuvers, where concentrations larger than a few squadrons were rarities, to current exercises where maneuvers by the group, wing, even the entire GHQ have become commonplace. The old air force thought largely in terms of opportunistic combats and bombing missions. The new air force thinks in terms of coordinated strategical plans for defending large areas or an entire seacoast.

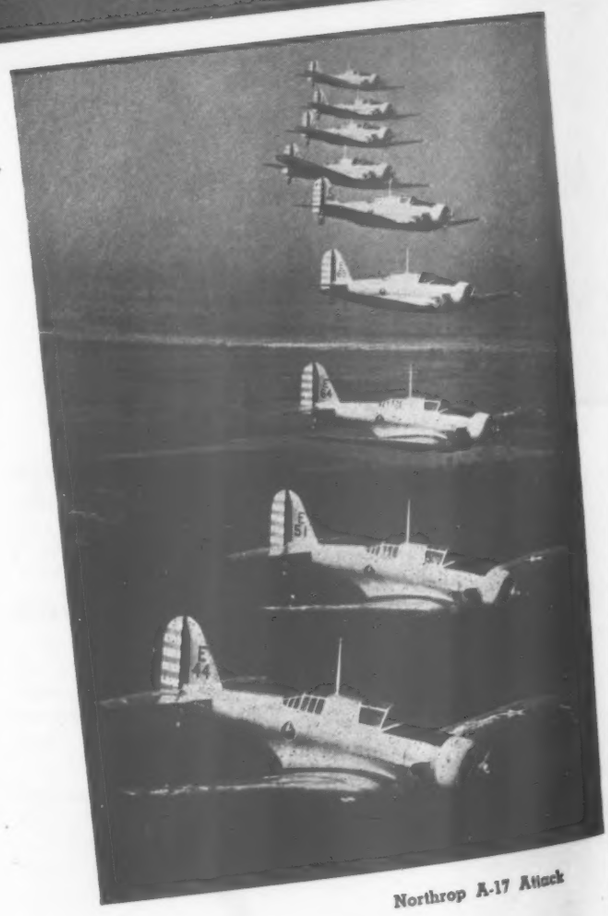
How has the GHQ set-up helped training?

First of all it made possible a uniform program of post-school training and a Corps-wide system of minimum fitness qualifications. The War Department as a result of the recommendation of the Chief of Air Corps was, for the first time, able to institute this uniform post-school training, and set up a uniform standard of fitness to be reached by all AC officials. Few other agencies have contributed so much to the modern technique of all-weather flying as the U. S. Army. But by 1935 it had become obvious that skill and experience in such flying was by no means uniform throughout the various squadrons, in fact most Air Corps flyers were definitely inferior in the art to the country's air line flyers.

At about the time of organization of GHQ air force, the War Department on recommendation of Gen. Foulois, then Chief of Air Corps, issued a training directive requiring all flyers including those on administrative jobs to do at least 100 flying hours of specific forms of training. This 100 hours included 35 hours cross-country, 10 hours instrument flying, 10 hours night flying, 5 hours formation. This was considered by the Chief of the Air Corps minimum flying commensurate with individual flying proficiency of his AC officers. Pilots in tactical units, in addition to this 100 hours were required to fly more than

"Super-fortress"—the Boeing XB-15

Seversky Pursuit



Northrop A-17 Attack

double that amount. This additional time was necessary for perfection of the organization as a combat team and to permit the individuals to become familiar with the solution of air problems pertaining to their jobs as members of the air force, or to perfect the observation aviation in the proper cooperation with ground units.

Has the GHQ set-up really improved morale?

It certainly has. A single visit to any GHQ field, or for that matter to any Air Corps post will convince you of that in a minute. The feeling of AC officers and men that they are doing a definite and important task; that they are as much on their own as they can possibly expect to be; that they are getting full Army backing—all these things have contributed.

Is the GHQ a completed, finished thing?

Don't be silly. It does seem, beyond doubt, a permanent institution. Its first year was labelled specifically as a trial period. After the first year of trial—and Lord knows it was trying—it was found that the basic idea of GHQ was sound and that organization into three wings was excellent, but that internal organization of groups and squadrons and the relation between air bases and tactical units located thereon as originally conceived was susceptible to material improvement. Based on the year's experience a new organization was set up for further trial and changes have been made frequently to attempt to secure best possible organization. The organization down to the individual squadrons is now pretty well worked out, as is also the relation and interdependence of the GHQ air force units and the air bases at which they are located. The details of the organization are still being studied and this ideal organization toward which they are striving has never been attained and probably never will be attained. By the time the test has shown just the correct organization required for proper utilization of certain equipment under conditions in existence during the test, new equipment is developed or the conditions change and the organization must be changed slightly to fit. This condition is normal in any living efficient organization. Right now the GHQ is still far below the strength of about 980 planes initially set for it. Its strategic base plan is not very far underway. It faces a shortage of officers and enlisted men if the Air Corps procurement program hits its alloted goal of 2,320 planes by June 30, 1940.

And is the Air Corps going to hit that goal?

Testimony at the last Congressional hearings by the Chief of Air Corps answered this one, "yes." The actual number of "project" plants (that is under five years old and not classified as experimental) on hand or planned for the AC as of June 30 of each year is shown below.

1935	1936	1937	1938	1939	1940
1,078	855	842	1,378	1,798	2,320

But the Chief of the Air Corps and the officials of the War Department have much to say on the difficulties of increasing the numerical strength of modern air forces. When the Baker Board sat down in 1934 to lay out its 2,320 quota, most military planes were still tube and fabric creations. Most bombers were still decently slow-pokey. The Air Force which had once purchased 4.5 pursuit planes to every bomber was still predominantly single seater. Today the Air Corps is buying bombers in practically equal quantities with pursuit; multi-engined ships in equal quantities with single-engined ones. That has made unit costs zoom sharply.

Then, too, modern all-metal high-performance planes are, type for type, much more costly per unit than the old

models. Bombardment types of the 1920's, for example, frequently cost as little as $20,000. At present, pursuit ship contracts run that much per unit. Twin-engine bombers now cost about $75,000 a piece, even when procured in large numbers, and the biggest four-engine fortresses cost almost a quarter of a million dollars each. And remember these prices are without engines and instruments. Engine costs per horsepower have changed little but each succeeding model of plane seems to have heavier power loading. Instrument and equipment once cost but a few hundred dollars per ship—now they will run up to five or more thousands per plane. All this makes it at least twice as expensive to add units to a 1938 air force as to, say, a 1930 one. Of course, dollar for dollar the Army is getting more striking power for defense than ever before. Numerical strength is what's so hard to catch. Nevertheless, it does look like the Corps will come within good shooting range of that 2,320 by the 1940 deadline. Meanwhile, before it is reached, it seems certain that the Baker Board's analysis of Air Corps needs will be replaced with a modern revaluation in terms not only of new equipment but also of new world alignments and the new importance of air power in the world's affairs.

Are there no factors offsetting this high cost of numerical increase?

There are at least three. First is the Army's aggressive development of the Basic trainer idea. (A basic trainer is an intermediate type between the primary trainer and the full-performance combat type. Once there was little need for such transition types. Now the difference in flying qualities between a training bi-plane and, say, a modern pursuit or bomber are so large it is economically reckless to turn new pilots directly loose on the latter types). By developing and buying the basic types, the Corps has saved a great deal of money not only in first cost but also in running expenses and replacements. Second is the Corps policy over the past several years of taking advantage of contract terms which lower prices with increased size of order or for repeat orders. Heavy ordering of the Douglas Bomber is one example. By thus purchasing planes in substantial blocks the Corps has been able to save as much as 15 to 20 per cent per unit. Third: It is probable that today's all-metal high-performance planes will be serviceable for longer than the current provision of five years. This however remains to be seen. Any such sharp technical advances as have featured the past half decade will continue to make planes strategically obsolete no matter how sound of wind and limb.

Has the sample-attached method of procurement worked out?

That depends on what you use for a yardstick. At first it didn't help any in speeding deliveries. The Air Corps first issues minimum specifications for what it wants. About a year later manufacturers submit their bids and a first finished ship. The War Department then takes some months to make up its mind. Thereafter it takes from six months to a year to get the actual production deliveries started. The change to the new system in 1934 plus the radical contemporary shifting in construction types almost completely dried up deliveries for the next year and a half. But during the past three fiscal years deliveries under the new system have been quite satisfactory. By the competitive bid system, too, quality of ships has been extremely high and prices have remained reasonable—to put it mildly. But the chief defect—and the Army is the first to admit it—is that the cost of the system is wildly out of line for the manufacturers. The winner of any given competition—if the resulting orders are large enough—is generally able to get his development bait back and make a modest profit. The losers stand to lose from several hundred thousand to a million or more in building a plane which may lose the contract by a very small margin.

Today, as we have said, the Air Corps itself recognizes that something must be done to ease the burden of those competitions. The Corps has already pointed toward that by buying several types by "experimental" contract, then extending its orders through "service test" contracts in lots of thirteen. This is already possible under the existing law. But the Corps would also like positive legal permission to purchase the second best model or in some cases the two second best. In many cases such ships have possessed one or more features fully deserving further development.

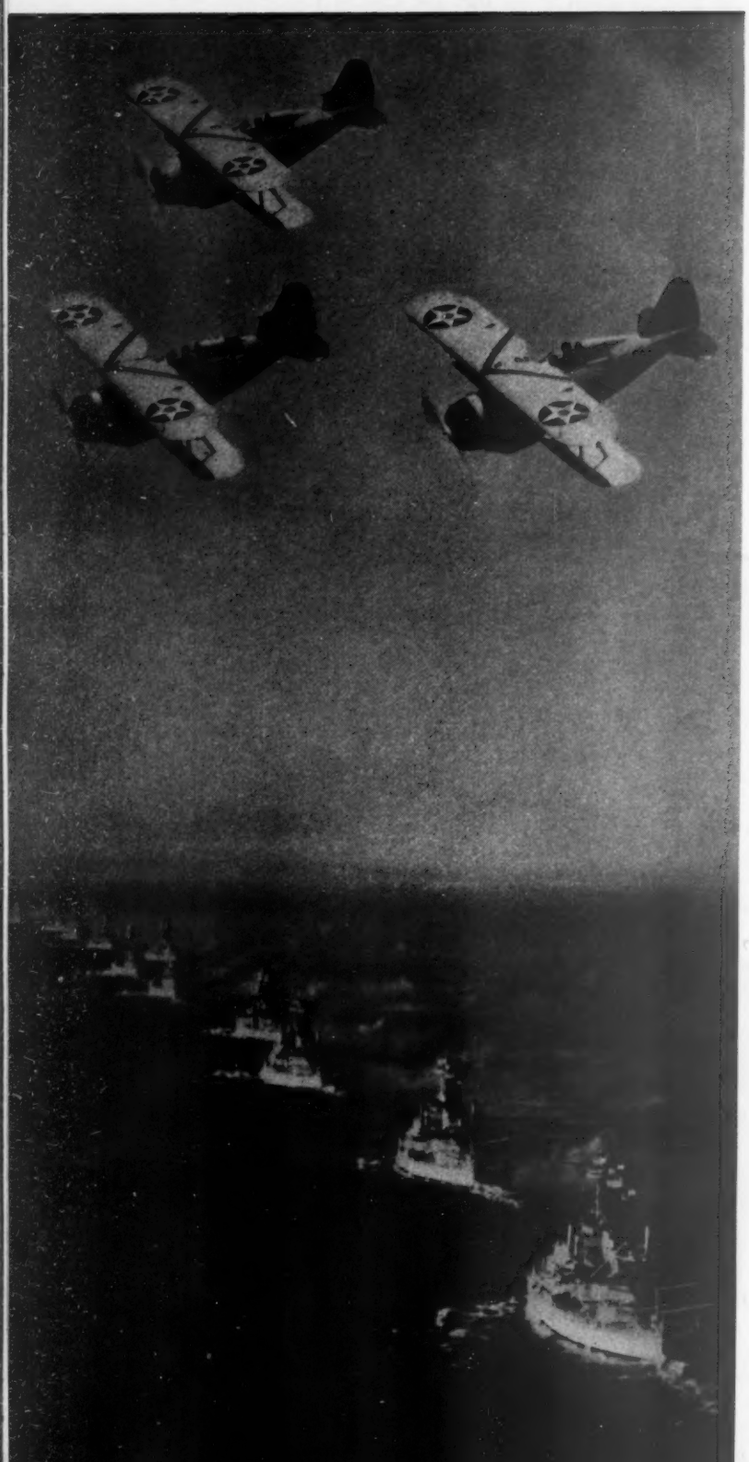
(*Turn to page 72*)

Curtiss XA-18 Attack

Bell's Airacuda

OUR AIR DEFENSES—II

The NAVY



Our far-flung air frontiers focus attention on the Navy's needs for long-range patrol squadrons and their attendant surface auxilliaries. The present three thousand plane program will relieve pressure in many directions, but still leaves gaps in our minimum program for national safety under present world conditions.

By S. Paul Johnston

Editor, Aviation

"ALL THE ENDEAVORS of naval aviation are directed toward one main objective,—to increase the efficiency and striking power of our fleet,"—thus Admiral Cook in a statement before the Naval Affairs Committee of the House of Representatives early this year. And that is the real point of departure in any consideration of the present and future of our flying fleets, for naval aviation is not an end in itself. It is only an adjunct (although an essential one) to our naval forces, and, in turn, to our whole scheme of national defense. Highly important, therefore, that the needs of our fleet air arm always be considered in the light of their relationship to other elements. In no other way may the defensive machinery be geared to function smoothly. All its parts must be well synchronized, whether they pertain to the land, sea or air.

No space here to relate the full record of aviation in our navy. Lieut. Miller ("Navy Wings") and other historians have wrought ably in that field, and we can only suggest that the reader go also to such sources if he is not already familiar with them. Without further preliminaries, then, let us take a long jump that will lands us into mid-summer of 1921.

On July 12, 1921 an act of Congress was approved which said, in part: "That there is hereby created and established in the Department of the Navy a Bureau of Aeronautics, which shall be charged with matters pertaining to naval aeronautics as may be prescribed by the Secretary of the Navy, and all the duties of said bureau shall be performed under the authority of the Secretary of the Navy. . . ."

Thus was created the organization that is the heart and nerve center of our naval aviation. It took rank with the other bureaus of the old sea-born navy,—with Navigation, Ordnance, Yards and Docks, Engineering, Construction

and Repair, Supplies and Accounts, Medicine and Surgery. At last, aeronautics was recognized as a full fledged part of a modern navy.

It is written into Regulations that the several bureaus of the Navy Department shall issue manuals which "shall contain information and instructions which pertain to the bureau or office by which issued." So, the Bureau of Aeronautics has its "bible," the familiar brown backed, loose-leaf document that contains the codified experience of over twenty years of naval flying. No more concise statement of the Bureau's duties can be found than in Art. 201 which states that they "comprise all that relates to design, building, fitting-out and repairs to naval and Marine Corps aircraft, their accessories and equipment, including aircraft and aerological instruments. . . ." In addition, the Bureau maintains all naval aeronautical establishments ashore, and also makes recommendations concerning all aeronautical matters as to operations, personnel and material to the appropriate bureaus and offices of the Navy and Marine Corps. Quite an order, but one which the Bureau has always carried out to the letter with the utmost efficiency and dispatch.

One of the Bureau's most important jobs is to consider the requirements of the operating branches and to develop types of aircraft best suited for their tactical needs. Years of study of the problem have resulted in the subdivision of fleet heavier-than-air operations into four general categories:

(1) Tender-based patrol bombing planes;
(2) Ship-borne seaplanes on battleships and cruisers;
(3) Ship-borne landplanes on aircraft carriers; or
(4) Aviation detachment of the fleet Marine forces.

In addition, the Navy possesses other aircraft of several types for nontactical transport and training uses. Practically all types are available for the use of the Naval Reserve as well as for the active squadrons.

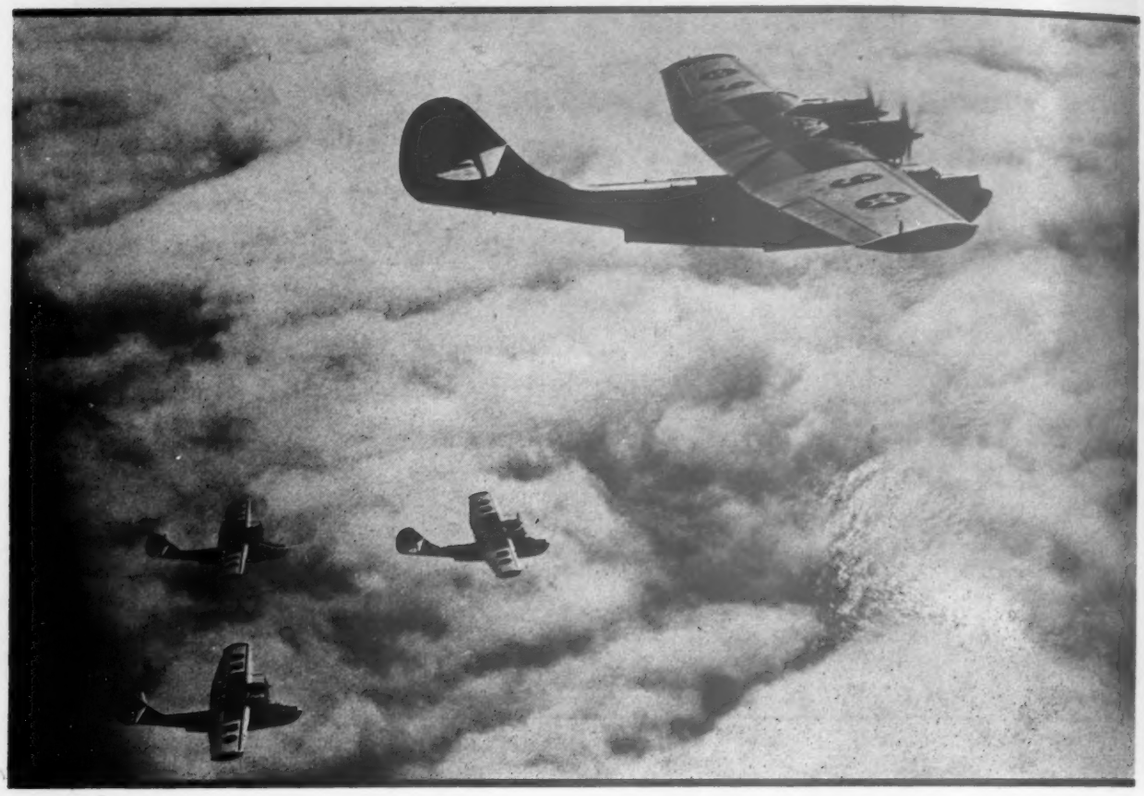
If any one thing has characterized our naval aviation in recent years, it has been the rise of the long range patrol bomber. It takes only a glance at the map of the western hemisphere to understand why this should be. Just as Great Britain's air frontiers extend to the banks of the Rhine, so our costal defense lines must embrace an area that extends from Alaska to Hawaii to the Canal Zone in the west,—to the Virgin Islands to Greenland in the east.

To operate successfully over such a vast area of ocean, extreme range, combined with the maximum of sea- and air-worthiness are essential. Furthermore, long range must not be attained at the expense of useful military load. Only within the past few years have airplanes and engine design progressed to the point where the patrol bomber as we know it today became feasible. Only within the past year or two have we been able to think in terms of operations such as the "routine transfers" of whole patrol squadrons over the thousands of miles of open sea between California and Hawaii. The potentialities of such types are limited only to the state of existing aeronautic development. Actually certain machines are well beyond the experimental stages whose range and load capacity are far beyond those of our present patrol fleets.

The popular press has frequently talked about "flying dreadnoughts,"—not without some justification. Within the year two large experimental types have been test-flown, the Consolidated XPB2Y-1 (AVIATION, January, 1938) and the Sikorsky XPBS-1 (AVIATION, September 1937), both four engined flying boats that are probably in the neighborhood of 70,000 pound gross weight.

Rumor has it that a super-boat has been projected for the Navy to cost in the neighborhood of $3,000,000, and about whose size we can only speculate. Navy people are very cautious about even admitting that such a project exists. So far, we know nothing about it, but by going back a few jumps in the history of commercial flying boat design we may get some clue as to the direction in which Navy design trends are probably heading.

It is unnecessary to go very far back into history to the Consolidated Commodore class, a "huge" flying boat of only five years ago. But the Commodore, all up, weighed only about 18,000 lb. Not long after that came the first Sikorsky Clipper, the S-40, at 34,000 lb. Followed shortly,



Consolidated PBYs

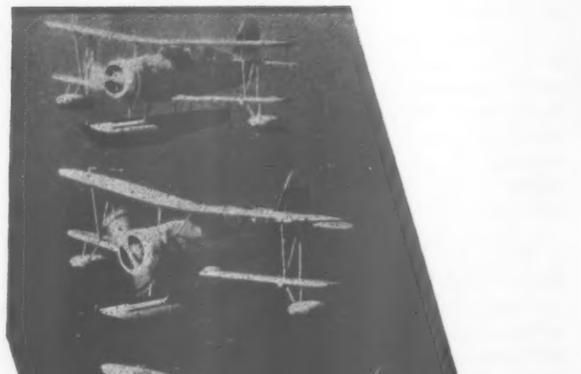
in order, the S-42 at 42,000 lb.; Martin's First China Clipper at 52,000 lb.; the Martin model 152 (built for Russia) at 63,000 lb.; the Boeing 314 at about 80,000 lb.; a new Consolidated design (not yet built) at 110,000 lb.; and finally the ships bid in on a Pan-American Airways specifications that must weigh, at a most conservative guess, upwards of 200,000 lb.

It is a safe bet, taking past performance as a criterion, then that each of these commercial designs has a Navy counterpart. Significant also that a new Navy PB classification has been set up, the LRPB or *long range* patrol boat.

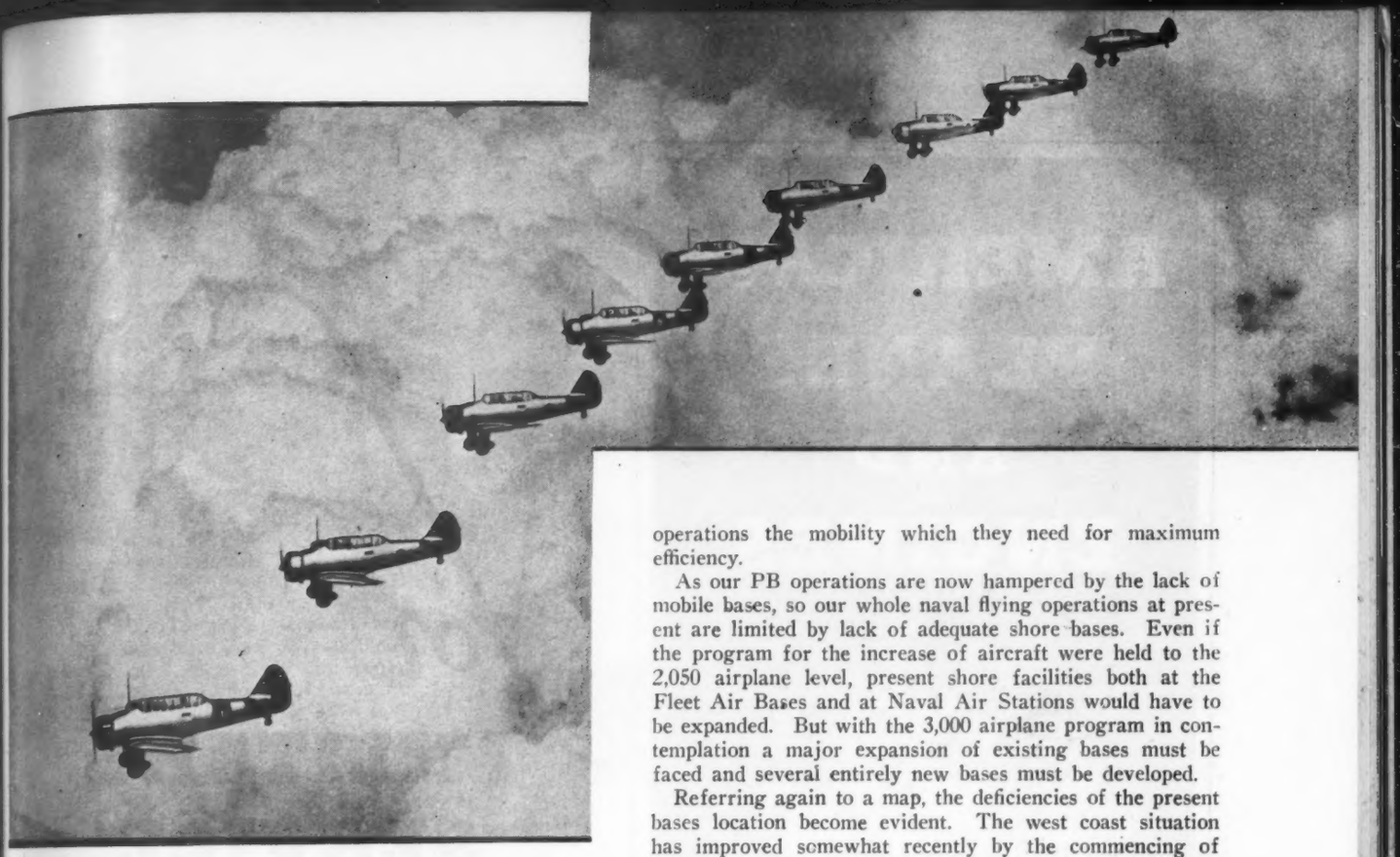
Admiral Leahy said in testimony before the House Naval Affairs Committee in February that he considered that the greatest need of our nation's air defense was an immediate increase in the number of Patrol Bombers. He estimated that the minimum number required for adequate defense in the Pacific alone was 428. It is a fair guess that defense required on other waters would add another 150 or so, making a total desirable Patrol boat strength close to 600 machines.

Working from the figures submitted by Admiral Cook during the hearings on the Naval appropriations bill for 1939, we have on hand at the present time about 170 Patrol Bombers in active service. In addition there are 43 machines of older types still on the active list (although on limited usage status). On order as of the early part of 1938 were 57 more machines many of which have actually been delivered this year. Adding up, we have in sight at the present time about 270 of the PB class, which leaves us just better than 300 machines short of the minimum which the Chief of Naval Operations considers reasonably adequate for our coastal defense.

Patrol planes are like surface ships, they cannot operate indefinitely on their own. They must be provided with bases of some sort where they may put in for supplies and



Curtiss SOCs



North American trainers

repairs. They can and do operate out of the land bases, but it takes little imagination to see that the effectiveness of patrol squadrons may be increased considerably by operating them from mobile bases, or tenders. From suitable tenders, ships of the PB class may be flown from any areas of reasonably sheltered water. Such water need not be in land-locked harbors, but may be found in the lee of an island or a reef. This availability of unlimited take-off and landing areas gives the seaplane patrol type a tremendous advantage over landplane bombers which require large, properly designed airports for their use.

At the present time, naval operations are seriously hampered by lack of supporting seaplane tenders. At the moment we have but two ships for this purpose,—the converted collier (and ex-carrier) "Langley," and the converted merchantman (and ex-balloon tender) "Wright." Both ships are old and neither are up to the specifications for a modern seaplane tender. In addition, several small vessels (formerly mine sweepers) do duty as small aircraft tenders, although they are scarcely satisfactory for service use. Shortly, two obsolete destroyers, the "Childs" and "Williamson" are to be de-commissioned and made over into aircraft tenders which will alleviate present pressure somewhat.

It is clear, however, under the new 3,000 plane program a number of new tenders will be needed. Admiral Leahy estimated that we will need four new large tenders (8,300 tons), each to handle two patrol plane squadrons (24 planes); and seven small tenders (1,650 tons), each to handle one squadron (12 planes). Actually the first of the large tenders, the "Curtiss," is now under construction and should be launched this year. One additional large tender and two of the small type have been authorized to be laid down during the current year. But the tender building program must be speeded up to match the airplane expansion if we are to guarantee our long range patrol operations the mobility which they need for maximum efficiency.

As our PB operations are now hampered by the lack of mobile bases, so our whole naval flying operations at present are limited by lack of adequate shore bases. Even if the program for the increase of aircraft were held to the 2,050 airplane level, present shore facilities both at the Fleet Air Bases and at Naval Air Stations would have to be expanded. But with the 3,000 airplane program in contemplation a major expansion of existing bases must be faced and several entirely new bases must be developed.

Referring again to a map, the deficiencies of the present bases location become evident. The west coast situation has improved somewhat recently by the commencing of bases at Sitka, (Alaska) and San Pedro, (California). This will help relieve the present congestion at Seattle, and San Diego. Improvements are also being made at Alameda, Pearl Harbor, Hawaii and Coco Solo. Two new bases have been surveyed in the far North, Kodiak and one further to the westward in the Aleutian Chain. The possibility of Samoa as a war-time base has also been studied.

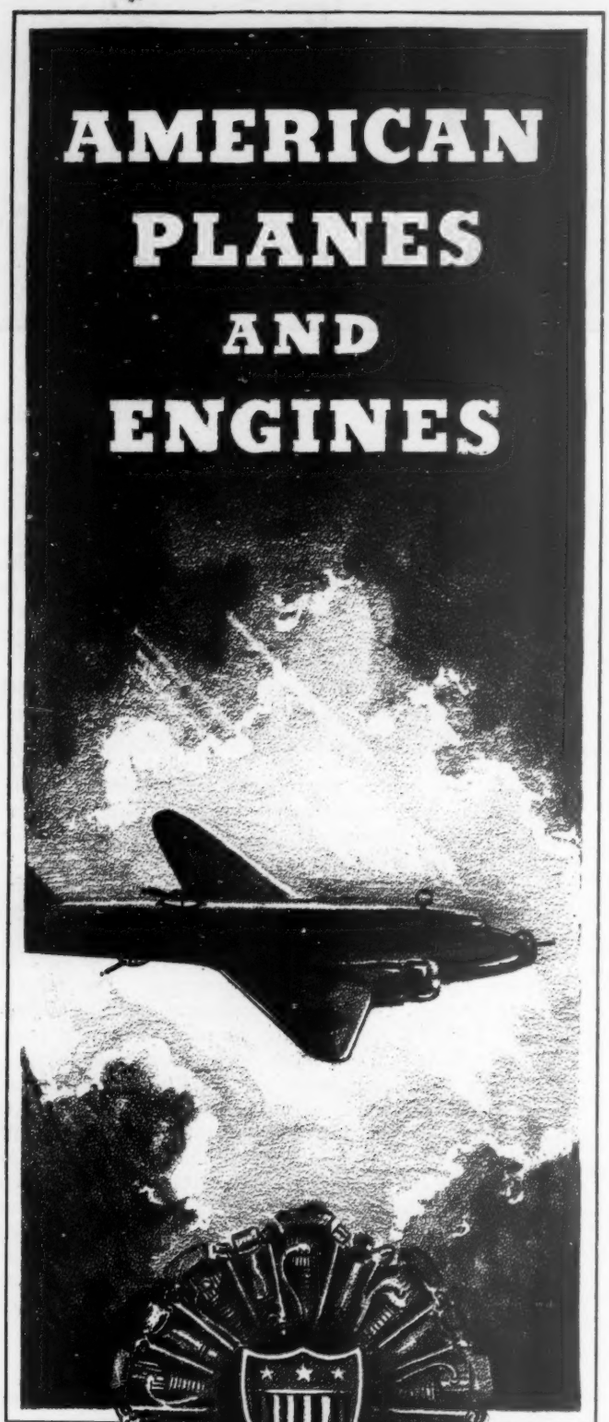
The Atlantic situation must, however, be considerably improved under any expansion program. The present bases at Norfolk, Pensacola, Guantanamo and St. Thomas (Virgin Islands) are scarcely adequate even for peace time operations. Navy plans include the establishment of at least four more bases,—at San Juan, at Quantico and at two other points as yet unnamed. The latter are to be known as the North East station and the South East station respectively. Each of these stations will be set up with a full complement of patrol and carrier units and would also incorporate service and overhaul facilities.

Last year the Navy Department derived some help from the public works program. A total of $2,800,000 of WPA money was made available to naval air stations and naval reserve air bases during the current fiscal year.

(*Turn to page 76*)

Sikorsky J class Utilities

AMERICAN PLANES AND ENGINES



for

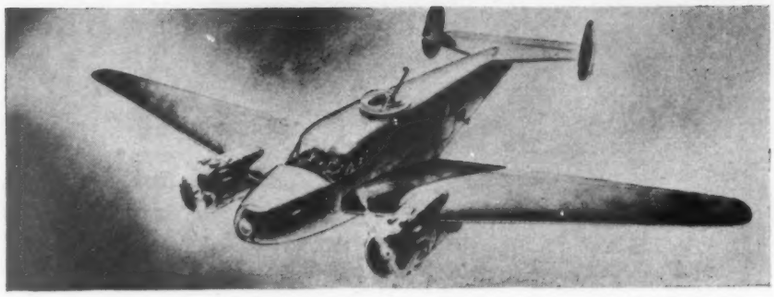
MILITARY SERVICE

The collective achievement of the designers and manufacturers of airplanes for military service are presented in the pages that follow: A glimpse at the specifications of this group of some three score models will quickly convince you that they are second to none in quality. In appraising them it must be remembered that many of them have been developed through a procurement system under which the manufacturer assumes the major responsibility for the successful performance of his product. Although such an arrangement works a severe hardship on the manufacturers, it has the single advantage of insuring excellence.

In the pages of this directory, airplanes are depicted in alphabetical order together with their essential specifications. Where several variations of the same model are available performance figures are given in the order of first mention. When only one figure is given it applies to all variations of the model under consideration. In all instances where wing areas are given the area of the ailerons are included. Complete specifications for the engine models used in these airplanes are presented in the table on page 42. The letter x following the head indicates availability for export.

Beechcraft M18S X

For bombing, photo observation, attack, and ambulance work. Engines, 2 Pratt & Whitney Wasp Jr. Performance (est.): maximum speed, 219 m.p.h. (S.L.), 230 m.p.h. (5000 ft.); landing, 62.5, 61, 64.5, 62.5 m.p.h.; service ceiling, 27,500, 29,000, 26,300, 27,700 ft. Weights: gross, 8265, 7539, 8415, 7705 lb.; empty, 4520 lb., 4620 lb. (ambulance). Dimensions: span, 47 ft., 8 in.; length, 34 ft., 3 in.; area, 347 sq.ft.



Bell BG-1 X

Bomber and Scout models. (Both Wright Cyclone R1820-F56.) Performance: high speed, 206, 210 m.p.h. (11,300 ft.); landing, 71.9 m.p.h.; service ceiling, 24,950, 28,500 ft.; range, 860, 1000 mi. Weights; gross, 6641, 5619 lb.; empty, 3819.5, 3774.5 lb. Dimensions: span, 36 ft.; length, 28 ft. 9 in.; area. 353.8 sq.ft.

Bell Airacuda, XFM-1

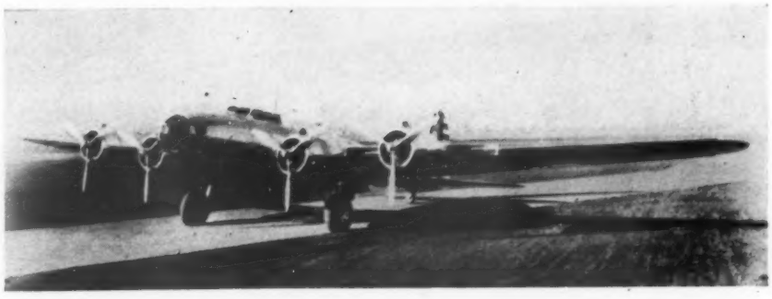
A multi-gun, twin engine fighter designed to combat the modern high speed bomber, the Bell Airacuda is now being produced for the Army Air Corps. Two 1000 hp. Allison liquid cooled engines drive pusher propellers leaving free field of fire for the noses of the nacelles. Details have not been released by the Air Corps.

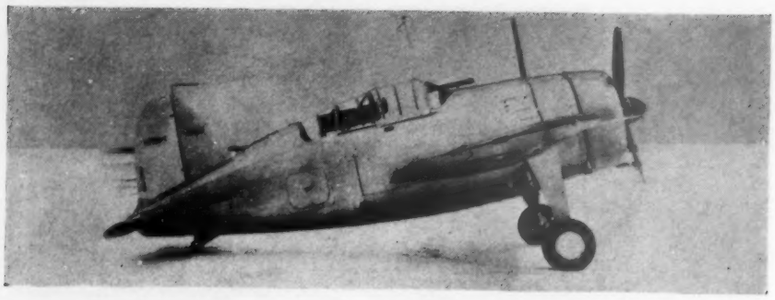
Bellanca 28—90, 28-110 X

Two engine installations. Pratt & Whitney, Twin Wasp Sr. 950 hp., and Twin Wasp C, 1100 hp. Performance: maximum speed, 280, 291 m.p.h.; cruising, 250 m.p.h. (6500 ft.) (28-90); stalling speed, 68 m.p.h. (28-90). Weights: gross, 8454 lb. (28-110); empty, 4450, 4775 lb.; bomb load (28-110), 1600 lb. Dimensions: span, 46 ft. 1⅞ in.; length, 26 ft. 6 in.; area, 279 sq.ft.

Boeing 299-Y X

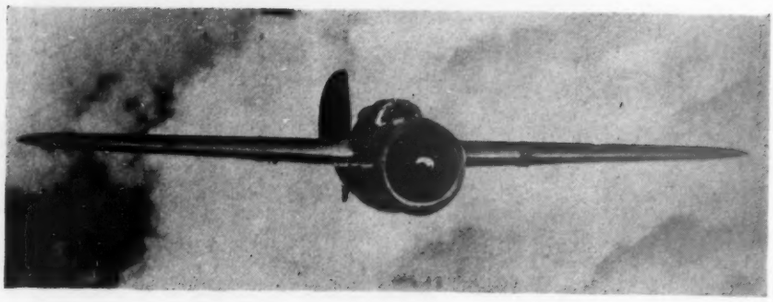
Known as the Army Air Corps B-17, Flying Fortress, and other designations, the 299-Y has been released for export. Structure, aluminum alloy; landing gear, retractable. Power plant 4 Wright Cyclone, Series G engines. Dimensions: span, 105 ft.; length, 70 ft.; height, 15 ft. Weights: 22 tons loaded; bombs and ammunition, 4½ tons. Performance: maximum speed, more than 250 m.p.h.; range, more than 3,000 miles.





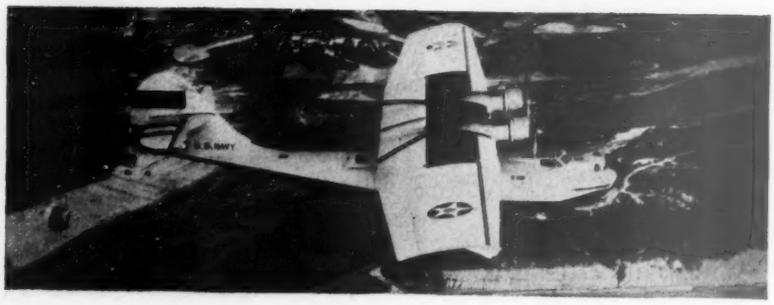
Brewster F2A1-Fighter

Production is now underway at the Brewster plant on the F2A1 single Seater Fighter. An order for 54 of these ships has been placed by the Navy Department and totals $1,910,395. Power plant is the Wright Cyclone engine. Hydraulically operated flaps and retractable landing gear are features.



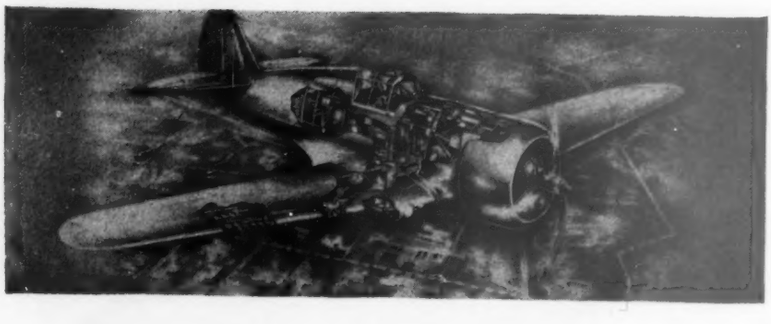
Brewster 138 Fighter-Bomber X

Counterpart of the F2A1 Fighter is the Model 138 Fighter-Bomber which has recently been released for export by the U. S. Navy. Power plant, performance and general design features of both ships are similar. Detailed specifications have not yet been released.



Consolidated PBY-1, 2 Bomber

The brilliant performance of the Consolidated patrol boats of the U. S. Navy is too well known to bear repetition. Power plant is 2—1,000 hp. Pratt & Whitney Twin Wasp engines. Dimensions (PBY-1) are: span, 104 ft.; length, 54 ft. 10 in.; height, 17 ft. 9 in. Performance figures have not yet been released.



Curtiss-Wright Hawk 75, 75A X

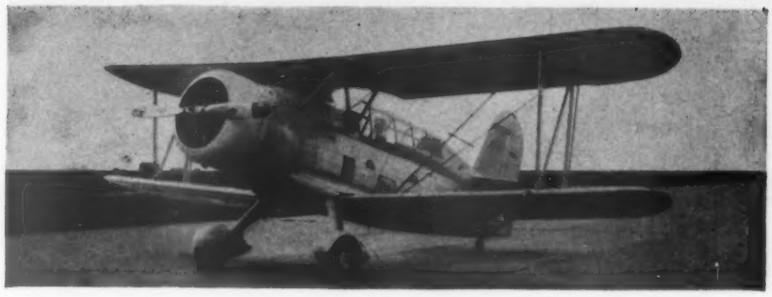
Engines—840 and 900 hp. Wright Cyclones. Performance: high speed, 273, 302 m.p.h. (crit.); cruising, 240-260 m.p.h. (crit.); stalling, 68.0, 68.1 m.p.h.; service ceiling, 31,800, 33,140 ft.; range, 1380, 1025 mi. Weights: gross, 5,172, 5,692 lb.; empty, 3,984, 4,483 lb. Dimensions: span, 37 ft. 4 in.; length, 28 ft. 10 in.; area, 236 sq.ft.

Curtiss-Wright Hawk III, IV X

Engines—both 775 hp. Wright Cyclones. Performance: high speed, 240, 248 m.p.h. (crit.); cruising, 204, 211 m.p.h. (crit.); stalling, 69 m.p.h.; service ceiling, 25,800 ft.; 29,700 ft.; range, 575, 577 mi. Weights: gross, 4,317, 4,598 lb.; empty, 3,213, 3,404 lb. Dimensions: span, 31 ft. 6 in.; length, 23 ft. 6 in.; area, 262 sq.ft.

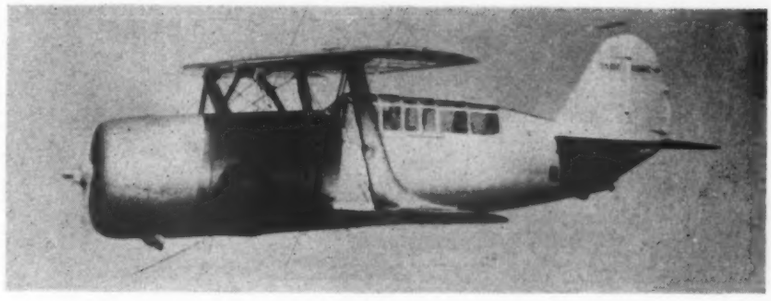
Curtiss-Wright Seagull X

Engine—550 hp. Pratt & Whitney Wasp. Performance: high speed, 168 m.p.h. (crit.); cruising, 137 m.p.h. (crit.); stalling, 56 m.p.h.; service ceiling, 16,070 ft.; range, 697 mi. Weights: gross, 5,192 lb.; empty, 3,543 lb. Dimensions: span; 36 ft.; length, overall, 26 ft. 6 in.; area, 342 sq.ft.



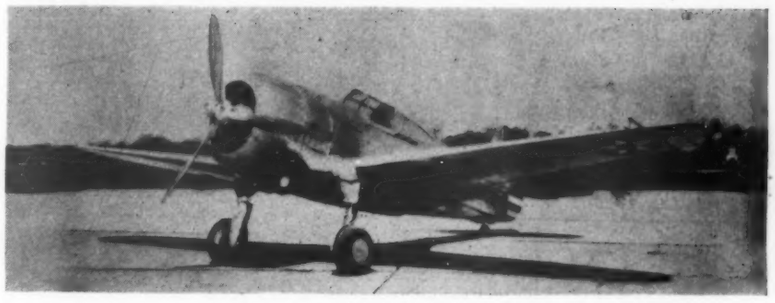
Curtiss Wright Helldiver 77 X

Wright Cyclone, 840 hp. Performance: high speed, 235 m.p.h. (crit.); cruising, 197 m.p.h. (crit.); stalling, 64 m.p.h.; service ceiling, 25,700 ft.; range, 610 mi. Weights: gross, 5,710 lb.; empty, 4,166 lb. Dimensions: span, 34 ft.; length, 27 ft. 6 in.; area, 317 sq.ft.



Curtiss-Wright P-36A

A single seater pursuit used extensively by the Army Air Corps. Power plant is the Wright Cyclone engine. This model is in current production at the Buffalo plant. Performance figures and weight data have not yet been released by the Air Corps. Dimensions: span, 37 ft. 4 in.; length overall, 28 ft. 10 in.; height overall, 9 ft. 3 in.

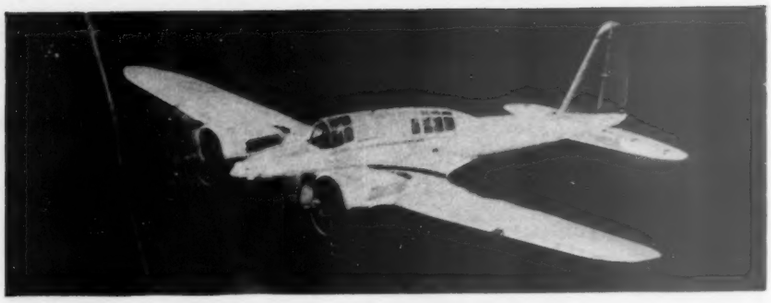


Curtiss-Wright Y1A-18 X

Purchased in large numbers by the Army Air Corps, the Y1A-18 twin engine attack plane is now in production at the Buffalo plant. Power plant is 2 Wright Cyclone engines. Construction is of metal. Dimensions: span, 59 ft. 6 in.; length overall, 41 ft.; height overall, 11 ft. 6 in.

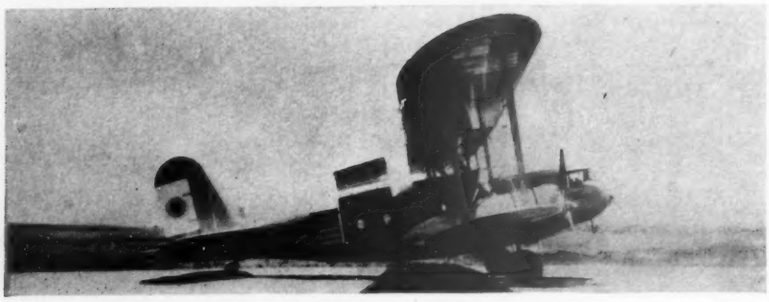
Curtiss-Wright YP-37

Air all metal monoplane pursuit, the YP-37 is powered by the liquid cooled Allison engine. This model marks the return of Curtiss-Wright to the manufacture of airplanes for other than air cooled engines. Dimensions: span, 37 ft. 3½ in. Weights and performance figures are not yet released by the Air Corps.



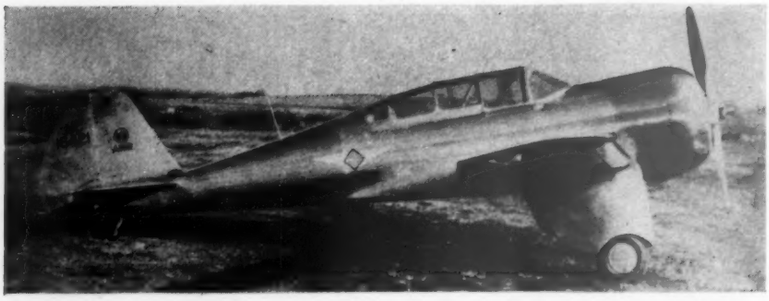
Curtiss-Wright Design 76-D X

Two Wright Cyclones (total, 1680 hp.). Performance: high speed, 266 m.p.h. (crit.); cruising, 224 m.p.h. (crit.); stalling, 72 m.p.h.; service ceiling, 30,900 ft.; range, 1600 mi. Weights: gross, 12,793 lb.; empty, 9,388 lb. Dimensions: span, 59 ft., 6 in.; length overall. 41 ft.; area, 530 sq.ft.



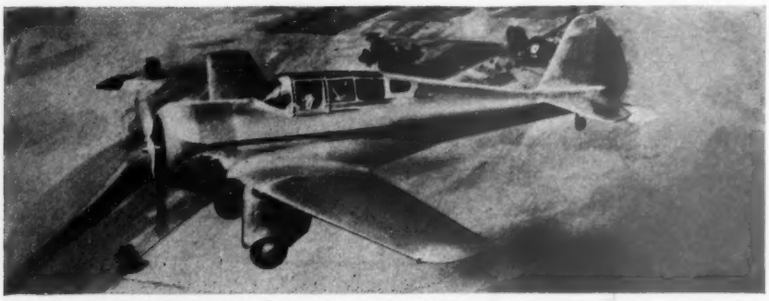
Curtiss-Wright CT-32 X

The Condor is still available as a day or night transport or cargo carrier. Power plant is 2 Wright Cyclones (Total, 1520 hp.) Performance: high speed, 184 m.p.h. (crit.); Cruising speed, 168 m.p.h. (crit.); stalling, 64 m.p.h.; service ceiling, 22,000 ft.; range, 650 mi. Weights: gross, 18,500 lb.; empty, 11,574 lb. Dimensions: span, 82 ft.; length, 48 ft. 7 in.; area, 1208 sq. ft.



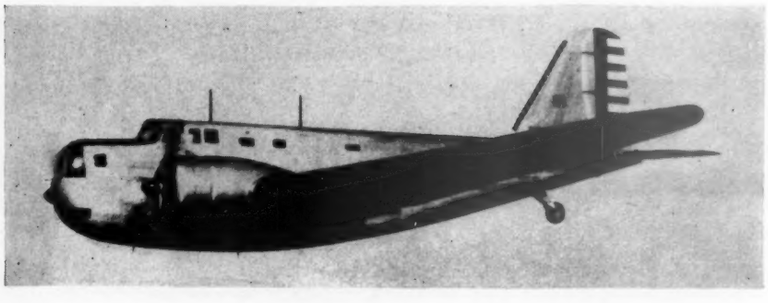
Curtiss-Wright A-19-R X

Similar in general design and dimensions to 19-R. Power plant, Wright Whirlwind, 420 hp. Performance: high speed 209 m.p.h. (2500 ft.); cruising, 191 m.p.h. (crit. alt.); landing 55.4 m.p.h.; service ceiling, 23,000 ft.; range 450 mi. Weights: gross, 3200 lb.; empty, 2018 lb.; Dimensions: span, 35 ft.; length, 26 ft. 4 in.; height, 7 ft. 6 in.; area, 174.3 sq.ft.



Curtiss-Wright 19-R X

For a number of military missions. Power plant, 420 hp. Wright Whirlwind engine. Performance: high speed, 209 m.p.h. (2500 ft.); cruising, 191 m.p.h. (crit. alt.); stalling, 55.4 m.p.h.; service ceiling, 22,000 ft.; range, 450 mi. Weights, gross, 3500 lb.; empty, 2118 lb. Dimensions: span, 35 ft.; length, 26 ft. 4 in.; height 7 ft. 6 in.; area, 174.3 sq.ft.

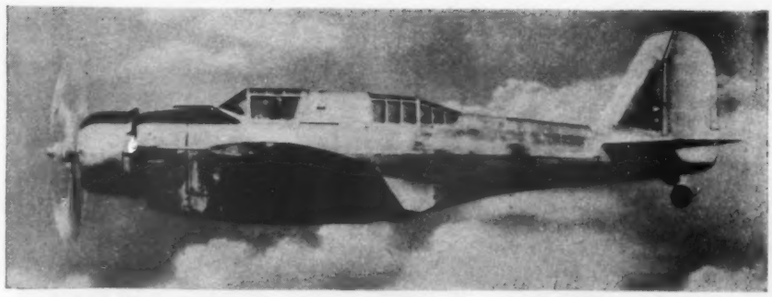


Douglas B-18 Bomber X

Purchased in substantial quantities by the Army Air Corps. Power plant, Wright Cyclone R-1820-45. Performance: high speed, 204 m.p.h.; cruising speed, 180 m.p.h.; stalling, 65 m.p.h.; service ceiling, 24,200 ft. Weights: gross, 23,200 lb.; empty, 15,175 lb.; Dimensions: span, 90 ft.; length, 56 ft. 9 in.; area, 965 sq.ft.

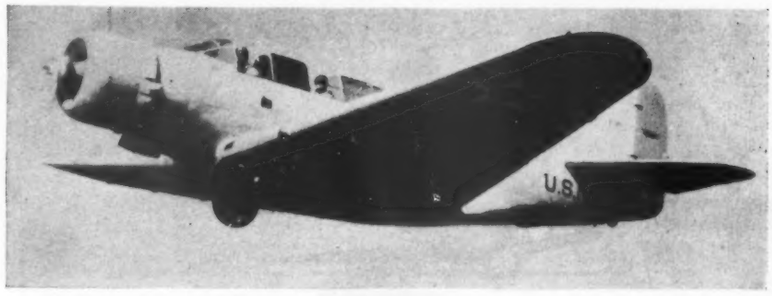
Douglas (El Segundo Div.) 8-A X

Purchased in large quantities for use as an attack plane by the U. S. Army Air Corps, the 8-A is a high performance low-wing monoplane of all-metal construction with a multi-cellular wing structure. It is available with several different engine installations. Released for export sales negotiations.



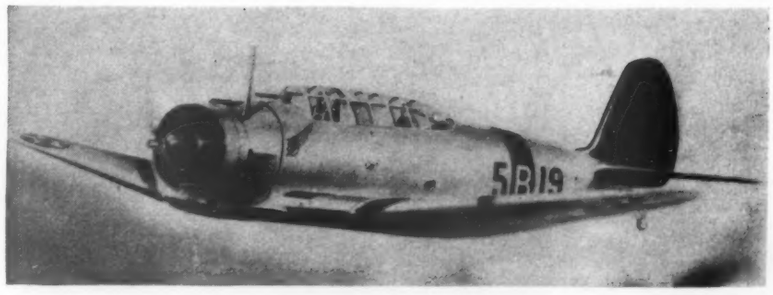
Douglas XTBD-1

Unusual in that it is a monoplane for aircraft carrier operation, the Douglas Torpedo Bomber XTBD-1 has been produced in large quantities for the Navy. Power plant is the 850 hp. Pratt & Whitney Twin Wasp with Hamilton-Standard Constant Speed Propeller. Specifications have not yet been released.



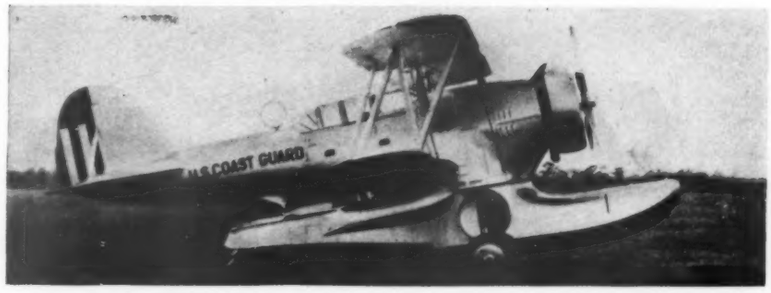
Douglas (El Segundo Div.) BT-1 X

A two seat dive bomber for the U. S. Navy, the BT-1 is somewhat similar to the Army A-17, but includes carrier equipment and other naval modifications. Engine, 750 hp. Pratt & Whitney Twin Wasp Jr., with Hamilton-Standard Constant Speed Propeller. Released for export sales negotiations. Specifications not available.



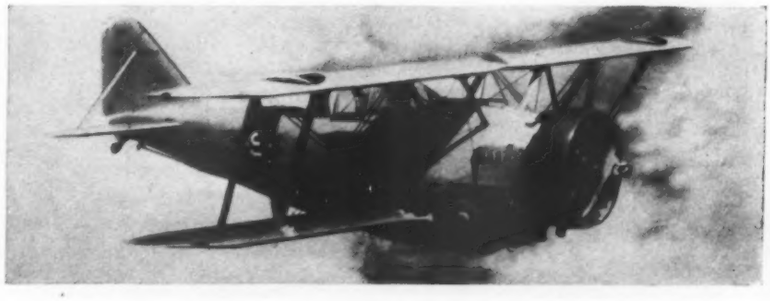
Grumman JF-2 Utility X

For photography, observation, and general utility missions. Power plant. Wright Cyclone, 775 hp. at 5800 ft. Performance: high speed, 185 m.p.h. (7000 ft.); cruising, 155 m.p.h. (7000 ft.); landing, 63 m.p.h.; service ceiling, 22,000 ft.; range, 620 mi. Weights: gross, 5760 lb.; empty, 4100 lb. Dimensions: span, 39 ft.; length, 33 ft.; area, 409 sq.ft.



Grumman FF1 Fighter X

A two-seater fighter powered by the Wright Cyclone engine. (775 hp. at 5800 ft.). Performance: high speed, 220 m.p.h. (7000 ft.); cruising, 200 m.p.h. (7000 ft.); landing, 65 m.p.h.; service ceiling, 25,000 ft.; range, 600 miles. Weights: gross, 4800 lb.; empty, 3200 lb. Dimensions: span, 34 ft. 6 in.; length, 24 ft., 6 in.; area, 310 sq.ft.



Grumman G-37

A single seater fighter powered with the Wright R-1820-G5 Cyclone, developing 750 hp.; at 15,200 ft. Performance: high speed, 270 m.p.h.; cruising, 243 m.p.h.; landing, 67 m.p.h.; service ceiling, 32,000 ft.; range, 590 mi. Weights: gross, 4553 lb.; empty, 3215 lb. Dimensions: span, 32 ft.; length, 32 ft., 3½ in.; area, 261 sq.ft. Retractable landing gear, Hamilton-Standard Controllable pitch propeller.

Grumman J2F1 Utility X

A two-four-place general utility amphibian. Power plant, Wright Cyclone, 775 hp. at 5800 ft. Performance: high speed, 180 m.p.h. (7000 ft.); cruising, 150 m.p.h. (7000 ft.); landing, 64 m.p.h.; service ceiling, 21,000 ft.; range, 780 mi. Weights: gross, 6170 lb.; empty, 4300 lb. Dimensions: span, 39 ft.; length, 34 ft; area, 409 sq.ft.

Grumman F3F-1, F3F-2 X

Two Fighter-Bombers. Power plants, Pratt & Whitney Wasp Jr. (650 hp.) Wright Cyclone (750 hp.) Weights: gross, 4100, 4620 lb.; empty, 2870, 3250 lb. Dimensions: span, 32 ft.; length, 23 ft. 3 in., 23 ft.; area 260 sq.ft. Performance figures have not yet been released by the Navy. Both are designed to carry 2–100-lb. bombs.

Grumman F2F-1 Fighter X

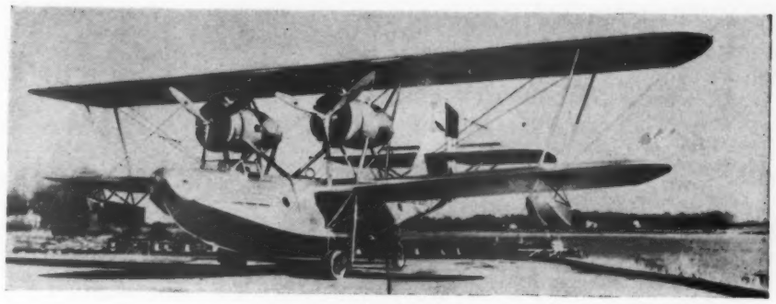
A single-seater biplane fighter. Power plant, Pratt & Whitney Wasp Jr., 650 hp. at 7,500 ft. Performance: high speed, 240 m.p.h. (7500 ft.); cruising, 215 m.p.h. (7500 ft.); landing, 65.5 m.p.h.; service ceiling, 27,500 ft.; range, 720 mi. Weights: gross, 3780 lb.; empty, 2625 lb. Dimensions: span 28 ft. 6 in.; length 21 ft. 5 in.; area, 230 sq.ft.

Hall PH-1 (Mod.) Patrol X

Normal and overload models (2 Wright Cyclones, total, 1520 hp.). Performance: maximum speed, 153.9, 153.5 m.p.h. (5800 ft.); cruising, 136.5, 136.0 m.p.h. (5800 ft.); stalling speed, 60.8, 62.6 m.p.h.; service ceiling, 22,600, 21,500 ft.; range, 750-900 mi. Weights: gross, 16250, 17173 lb; empty, 9320 lb. Dimensions: span 72 ft. 10 in.; length, 51 ft. 10 in.; area, 1170 sq.ft. U.S. Navy Patrol, Bomber, Flying Boat.

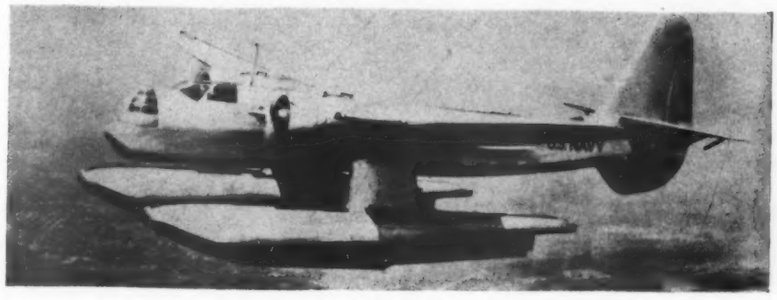
Hall PH-2 Patrol X

Normal and overload models (2 Wright Cyclones, total 1500 hp.) Performance: maximum speed, 155.2, 154.9 m.p.h. (3200 ft.); cruising, 137.5, 137.2 m.p.h. (3200 ft.); stalling, 60, 61.2 m.p.h. Service ceiling, 22,200, 21,100 ft. Range, 1928, 2242 miles; Weights: gross, 15,547, 16,459 lb.; empty, 9275 lb.; Dimensions: span, 72 ft. 10 in.; length, 51 ft.; area, 1170 sq.ft. Development of PH; for Coast Guard.



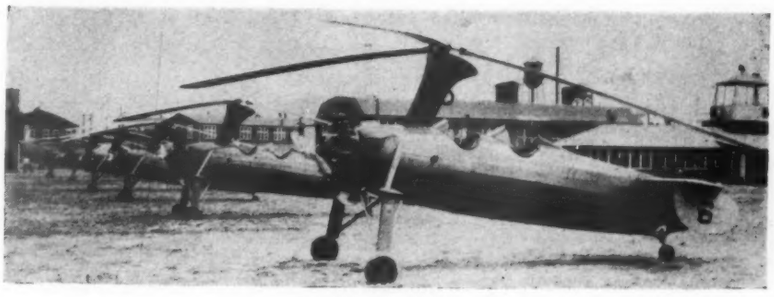
Hall-C-383 Torpedo Bomber X

Powered with 2 Wright Cyclones, total 1800 hp. Performance and weights not released by U. S. Navy. Dimensions: span, 79 ft. 4 in.; length overall, 55 ft. 4 in.; height overall, 21 ft.; area, 828.5 sq.ft. A twin float, twin engine torpedo bomber patrol seaplane, a development of the XPTBH-2 tested and accepted by the Navy.



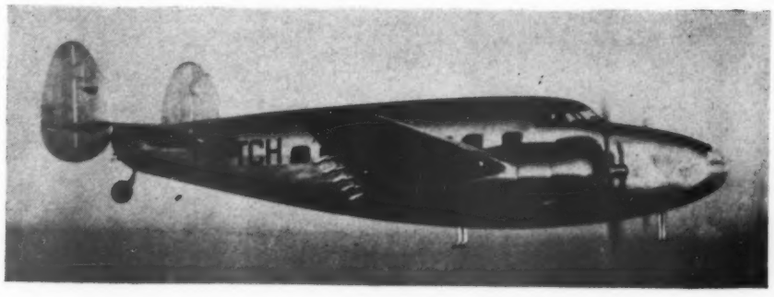
Kellett Autogiro YG-1B X

Seven delivered to U. S. Army Air Corps in past year. Engine, Jacobs 225 hp. Performance: maximum speed, 128 m.p.h.; cruising speed (S.L.), 103 m.p.h. Weights: gross, 2269 lb.; empty, 1619 lb. Dimensions: Disc Diamater, 40 ft.; length overall, 28 ft. 10 in.; blade area, 55.2 sq.ft. The YG-IB embodies only slight modifications of its predecessor design, the YG-IA.



Lockheed 14 X

Designed and built as a convertible transport-bomber. Engines, 2 Wright Cyclones, (GR 1820-G 3B). Performance: high speed, 260 m.p.h. (9300 ft.); cruising, 240 m.p.h. (13,800 ft.); stalling, 65 m.p.h.; service ceiling, 27,400 ft. Weights: gross, 15,500 lb. Dimensions: span, 65 ft., 6 in.; length (thrust line level), 44 ft., 3¼ in.; area 551 sq.ft.



Martin 166 Bomber X

Two engine installations—Wright Cyclones (1800 hp.), Pratt & Whitney Wasps (2100 hp.). Performance: maximum speed, 260 (18,500 ft.), 260 (8,000 ft.); stalling speed, 66, 68 m.p.h.; service ceiling, 22,000, 24,800 ft.; range, 2080, 2000 mi. Weights: gross, 15,700, 16,000 lb.; empty, 10,400, 10,700 lb. Dimensions: span, 70 ft. 6 in.; length overall, 44 ft. 9 in.; area, 678 sq.ft.

North American NA-44 X

Light attack dive bomber. Engine, Wright Cyclone, F-52. Performance: maximum speed, 250 m.p.h. (7500 ft.); cruising, 225 m.p.h. (15,000 ft.); stalling speed, 70 m.p.h.; service ceiling, 25,000 ft.; range, 1050 mi. Weights: gross, 5998 lb.; empty, 4241 lb. Dimensions: span, 43 ft.; length, 23 ft. 9 in.; area, 225.76 sq.ft. The NA50, Single Seater Fighter with 270 m.p.h. (10,000 ft.) top speed, soon will be available.

North American NA-16-1, 2, 4 X

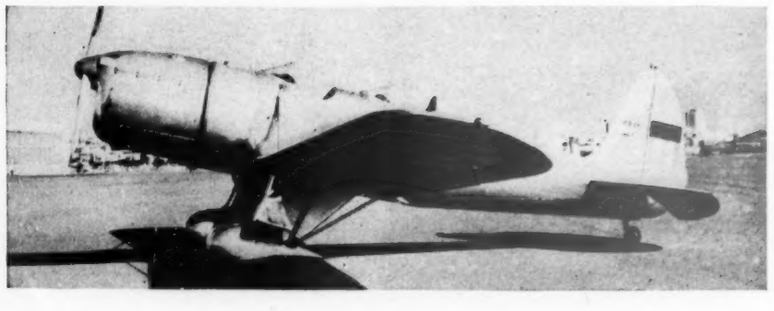
Pratt & Whitney, S3H1, S2H1, Wright Whirlwind, 420 hp. Performance: maximum speed, 207 (5000 ft.), 208 (10,500 ft.), 180 (1400 ft.); cruising, 187 (16,000 ft.), 185 (15,250 ft.), 166 (13,500 ft.); stalling, 62, 62, 57 m.p.h.; range, 630, 700, 800 mi. Weights: gross, 4556, 4693, 4024 lb.; empty, 3340, 3395, 2949 lb. Dimensions: span, 42 ft.; length, 27 ft. 5 13/16 in.; area, 248.26 sq.ft. Photo, NA16-2A.

North American NA-16-3 X

Combat bomber. Pratt & Whitney S3HI (550 hp.). Performance: maximum speed, 210 m.p.h. (5000 ft.); cruising speed, 190 m.p.h. (16,000 ft.); stalling speed, 62 m.p.h.; service ceiling, 23,000 ft.; range, 750 miles. Weights: gross, 5156 lb.; empty, 3818 lb. Dimensions: span, 43 ft.; length, 27 ft. 5 13/16 in.; area, 256 sq.ft. Photo, NA16-1GV.

North American NA-16-5 X

A primary trainer based on the familiar NA-16 design. Power plant, Wright Whirlwind, 250 hp. Performance: maximum speed, 142 m.p.h. (S.L.); cruising speed, 120 m.p.h. (S.L.); stalling speed, 52 m.p.h.; service ceiling, 20,000; range, 384 mi. Weights: gross, 3100 lb.; empty, 2490. Dimensions: span, 42 ft., length overall, 27 ft. 5 13/16 in.; area, 248.26 sq.ft.



Ryan ST Trainer X

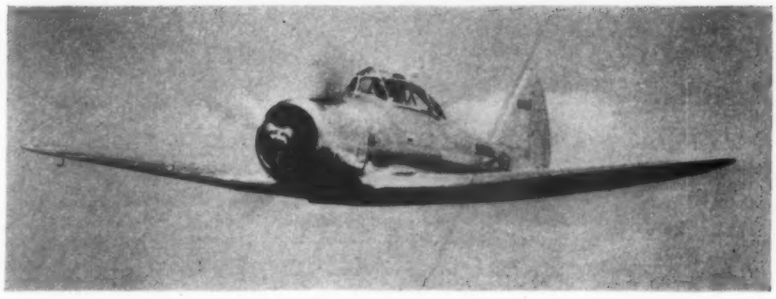
Four Menasco powered models—ST, STA, STA Special, and STM. 95-150 hp. Performance: Maximum speed, 140, 150, 160, 160 m.p.h.; cruising speed, 120, 127, 135 (3000 ft.), 135 m.p.h. (3000 ft.); landing speed (with flaps) 42 m.p.h.; service ceiling, 15,500-21000 ft. Fuel capacity, 24 gal. Dimensions: span, 29 ft. 11 in.; length, 21 ft., 5⅝ in.; area, 124 sq. ft. Weights: gross, 1600 lb.: empty 1028-1058 lb.

Seversky Convoy Fighter X

In two models varying only in dimensions but with several different engines. specifications are for Wright Cyclone version. Performance: high speed, 300 m.p.h. (16,500 ft.); cruising speed, 240 m.p.h. (12,000 ft.); stalling, 65 m.p.h.; service ceiling, 27,000 ft.; range, 2,700 mi. Weights: gross, 5952 lb.; empty 4034 lb. Dimensions: span, 36 ft., 41 ft.; length, 25 ft. 4½ in.; area 220, 250 sq.ft.

Seversky EP-1 X

An export version of the P-35. Power plant, Pratt & Whitney 1830-C. Two fuel capacities, 400 and 200 gal. Performance: high speed, 330 m.p.h. (6500 ft.); cruising speed, 290 m.p.h. (14,000 ft.); service ceiling, 29,500 ft.; range, 2650, 1450 mi.; Weights: gross, 7530.8, 6195.7 lb.; empty, 4405.4 lb. Dimensions: span 36 ft., length, 25 ft. 4 in.; area, 220 sq.ft.



Spartan Zeus 8-W X

First military model of the Spartan Company is the Zeus. Power plant, 550 hp. Pratt & Whitney Wasp. Performance: high speed, 234 m.p.h. (5000 ft.); cruising, 218 m.p.h. (10,000 ft.); landing, 65 m.p.h.; service ceiling, 29,400 ft.; range, 760 mi. Weights: gross, 4953 lb.; empty, 3440 lb. Dimensions: span, 39 ft.; length, 27 ft. 3 in.; area, 256 sq.ft.

Spartan 7W-F X

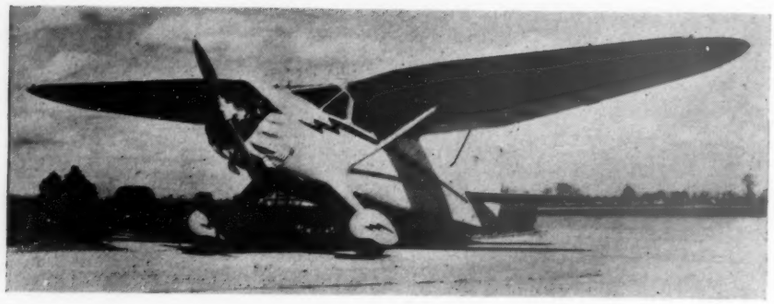
A commercial plane quickly convertible to a fighter and bomber. Engine, 400 hp. Pratt & Whitney Wasp Jr. Performance: high speed, 212 m.p.h. (5000 ft.); cruising, 200 m.p.h. (9600 ft.); landing, 66 m.p.h.; service ceiling, 24,000 ft.; range, 900 mi. Weights: gross, 4540 lb.; empty, 3067 lb. Dimensions: span, 39 ft.; length, 26 ft. 10 in.; area, 250 sq.ft.

Stearman 73 L3 X

Two basic models, both 225 hp. Lycomings. Performance: maximum speed, 123, 124 m.p.h. (S.L.); cruising speed, 105, 107 m.p.h. (S.L.); landing speed, 51, 54 m.p.h.; service ceiling, 13,500, 12,400 ft.; range 320, 390 mi. Weights: gross, 2,626, 2,690 lb.; empty, 1,938, 2,005 lb. Dimensions: span, 32 ft. 2 in.; length, 25 ft. ¼ in.; area, 297.4, 297.6 sq.ft. Available in 225-420 hp. range.

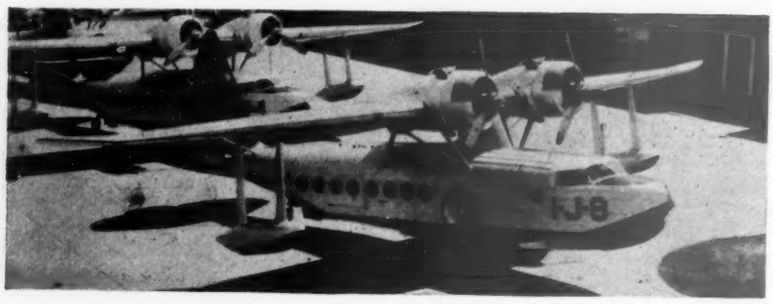
Stearman 76 X

Three basic models—two 76 D1 (Pratt & Whitney 320 hp. Wasp Jr.) and one 76 C3 (Wright Whirlwind, 420 hp.). Performance: maximum speed, 153, 151, 156 m.p.h. (S.L.); cruising, 135, 132, 136 m.p.h. (S.L.); landing speed, 56, 57, 59 m.p.h.; range, 472, 505, 695 mi. Weights: gross, 3,336, 3,240, 3,530 lb.; empty, 2,110, 2,371, 2,561 lb. Dimensions: span, 32 ft. 2 in.; length, 24 ft. 1 in.; 24 ft. 5 in., 24 ft. 3 in.; area, 297.6 sq.ft. Other variations available.



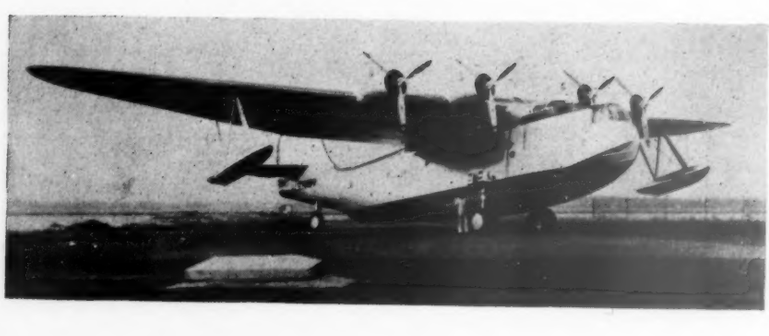
Stinson SR-10 X

For ambulance and transport service. In six models—two Lycoming, two Wright, and two Pratt & Whitney. Power range—245-450 hp. Performance: cruising speeds, 145.8 (4000 ft.), 175 m.p.h. (9700 ft.); stalling speeds, 57.5-63 m.p.h.; service ceiling, 13,200-22,500 ft.; range, 650-810 mi. Weights: gross, 3875-4650 lb.; empty, 2563-3075 lb. Dimensions: span, 41 ft.; 10½ in.; length, 27 ft. 7½ in.-27 ft. 10¾ in.; area, 258.5 sq. ft.



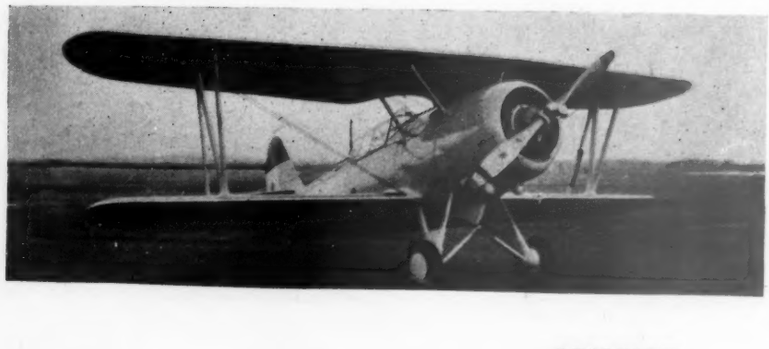
United-Sikorsky S-43 X

Power plant, 2 Pratt & Whitney Hornets, total 1500 hp. Performance: maximum speed, 190 m.p.h. (7000 ft.); cruising speed, 166 m.p.h. (7000 ft.); stalling speed, 65 m.p.h.; service ceiling, 19,000 ft. Weights: gross, 19,500 lb.; empty, 12,900 lb. Dimensions: span, 86 ft.; length overall, 51 ft. 2 in.; height, 17 ft. 8 in.; area, 780.6 sq.ft. Used by U. S. Navy.



United-Sikorsky XPBS-1

Developed as part of the Navy's large flying boat program, the Sikorsky XPBS-1 remains on the secret list and its specifications are not yet available for publication. The XPBS-1 exceeds previous Sikorsky commercial boats in weight by some 5 or 6 tons. Power plant is 4 Pratt & Whitney Twin Wasp engines of 1050 hp. each. Range and load carrying capacity are exceptionally large.

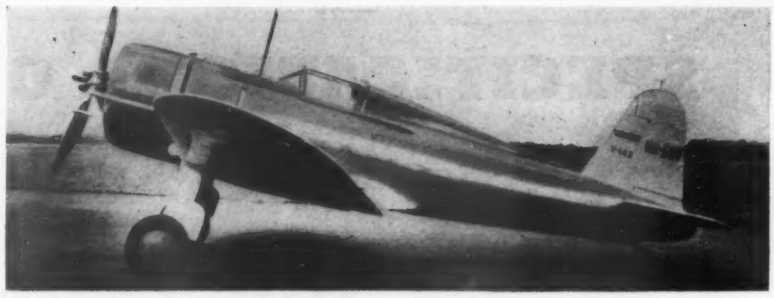


United-Vought V-142 X

An equal span, high performance biplane. Power plant, 750 hp. Pratt & Whitney Wasp Jr. Performance: maximum speed, 208 m.p.h. (9,000 ft.); cruising speed, 172 m.p.h. (9,000 ft.); stalling speed, 65 m.p.h.; service ceiling, 24,200 ft. Weights: gross, 5,445 lb.; empty, 3,550 lb. Dimensions: span, 33 ft. 3 in.; length overall, 27 ft. 9⅛ in.; area, 327 sq.ft.

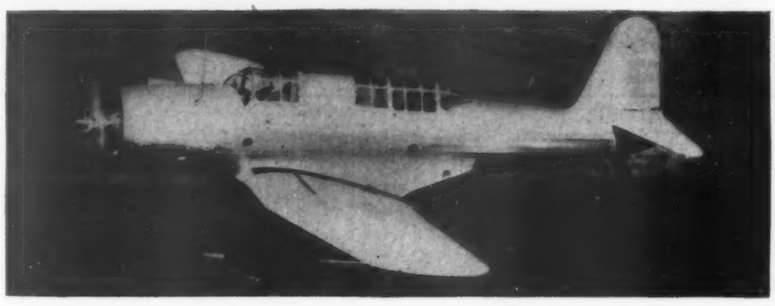
United-Vought V-143 X

Single seater fighter powered by 750 hp. Pratt & Whitney Twin Wasp Jr. With single row Wasp Jr., designation is V-150. Performance: maximum speed, 300 m.p.h. (11,000 ft.); cruising speed, 257 m.p.h. (18,000 ft.); stalling speed, 65 m.p.h.; service ceiling, 30,600 ft.; range, 951 mi. Weights: gross, 4,370 lb.; empty, 3,406 lb. Dimensions: span, 33 ft., 6 in.; length overall, 26 ft.; area, 187 sq.ft.



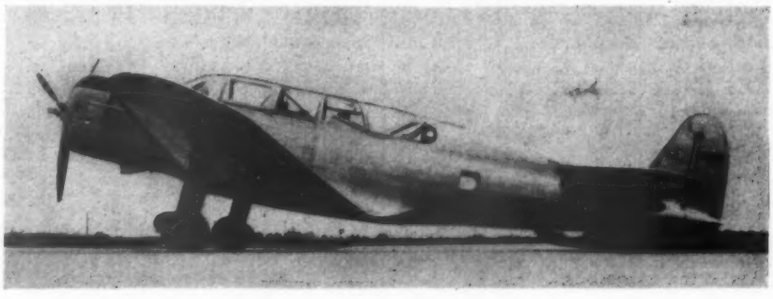
United-Vought V-156 X

Substantially similar to Model SB2U-1 scout dive bomber designed for U. S. Navy. Other specifications and performance figures are available on request. Engine, 750 hp. Pratt & Whitney Wasp Jr. Performance: range, 701 mi. Weights: gross, 6,500 lb.; Dimensions: span, 42 ft.; length overall, 33 ft. 11¾ in.; area, 305.3 sq.ft.



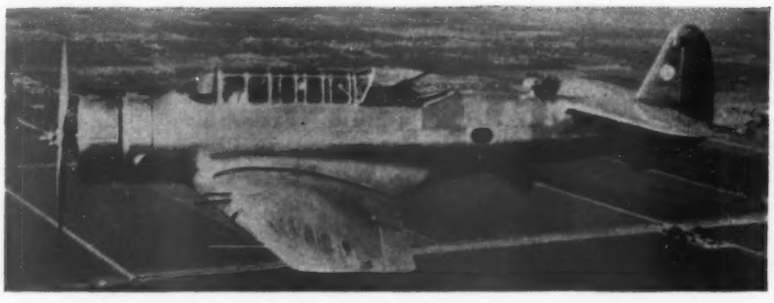
Vultee V-12 Attack Bomber X

Two versions, attack and bomber. Both Wright Cyclone GR-1820-G105A. Performance: maximum speed, 220 m.p.h. (S.L.), 210 m.p.h. (S.L.); cruising, 217 m.p.h. (15,000 ft.); 200 m.p.h. (15,000 ft.); service ceiling, 27,300 22,400 ft.; range, 1,075, 2,100 mi. Weights: gross, 9,941, 12,103 lb.; empty, 6,602, 6,517 lb. Dimensions: span, 50 ft.; length, 37 ft., 5½ in.; area, 384 sq.ft.



Vultee V11-GB Attack Bomber X

Two versions, attack and bomber. Both Wright Cyclone GR-1820-G105A. Performance: maximum speed, 217 m.p.h. (S.L.), 207 m.p.h. (S.L.); cruising, 214 m.p.h. (15,000 ft.), 198 m.p.h. (15,000 ft.); service ceiling, 28,000, 24,000 ft.; range, 1060, 2050 mi. Weights: gross, 9863, 11,-799 lb.; empty, 6500, 6415 lb. Dimensions: span, 50 ft.; length, 37 ft., 5½ in.; area, 384 sq.ft.



Waco D X

Four models. JHD (Wright R975-E1), WHD (Wright R975-E3), S3HD (Pratt & Whitney Wasp Jr.-TB) S2HD (Pratt & Whitney Wasp Jr.-SB). Performance: maximum speed (S.L.), 170, 180, 180, 175 m.p.h.; cruising speed (optimum altitude) 155, 162, 160, 158 m.p.h. 5-8 m.p.h. increases with controllable pitch propeller. Weights: gross, 3800 lb. Dimensions: span (overall), 32 ft., 8⅜ in.; length 25 ft. 6½ in.; area, 256.3 sq.ft. Model F. series also available as a trainer.

SPECIFICATIONS OF ENGINES

Mentioned in This

DIRECTORY

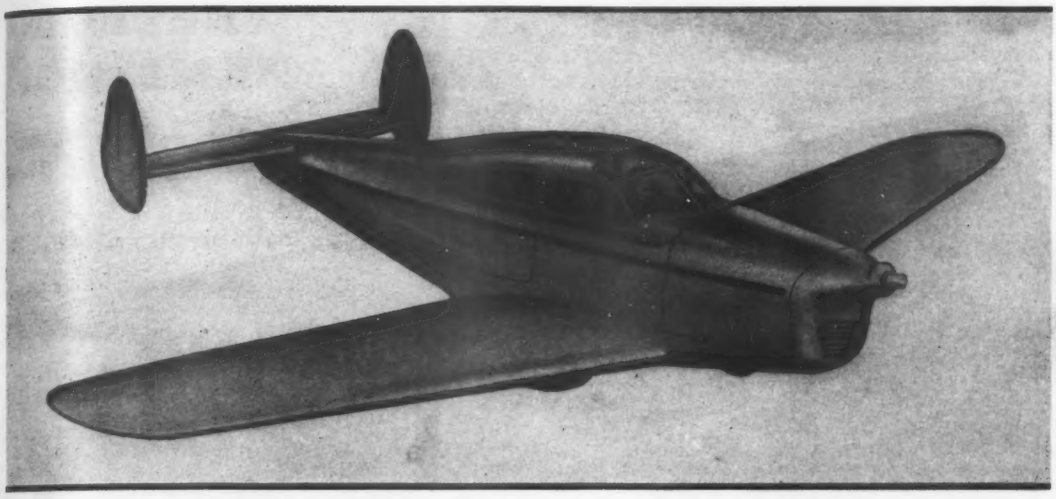
AVIATION does not assume responsibility for the figures given

Manufacturer	Model	Cooling System	Number of Cylinders	Cylinder Arrangement	Propeller Drive	Rating: Rated Hp.	Rating: At R.P.M.	Rating: At Altitude (ft.)	Rating: Octane Fuel	Weights: Total dry without hub or starter	Weights: lb. per hp.	Bore and stroke (in.)	Displacement (cu. in.)	Compression Ratio	B.M.E.P.	Blower Ratio	Dimensions: Diam. Mount. Ring or distance between bearers	Dimensions: Ht. or O.D. (in.)	Dimensions: Length without starter	Guaranteed fuel consumption at rated hp. (lb. per hp.-hr.)	Oil Consumption (lb. per hp-hr.)	Valve[9] Mechanism	Cylinder Construction (See footnote)	Make spark plugs supplied with engine	Type Ignition	Make Ignition	Make of Carburetors	Make of Starter	Are exhaust manifolds provided	Shipping weight (lb.)	Dry wt. (lb.)	Dimensions (in.)
Allison Engrg. Co.	V-1710-C6	W	12	V	G[5]	1000	2600	S.L.	87	1280	1.28	5½x6	1710.5	6.00	178	o.75	18⅜	42'3⅝	94'3½	.60	.025	ohc[2]	Al,S Cu	BG	DM	Sc	Ag	Eo	No	1930	1771	
Aviation Mfg. Corp. (Lycoming)	R-530-D1	A	7	Rad	D	220	2300	S.L.	80	425	1.93	4⅝x4½	529.2	6.50	143	—	19½	43½	34¼	.52[3]	.025	prr	Al,S	BG	DM	Se	Ag	Eo	No	925	785	
Aviation Mfg. Corp. (Lycoming)	R-530-D2	A	7	Rad	D	210	2300	S.L.	73	425	2.02	4⅝x4½	529.2	5.50	137	—	19½	43½	34¼	.52[3]	.025	prr	Al,S	BG	DM	Se	Ag	Eo	No	925	785	
Aviation Mfg. Corp. (Lycoming)	R-680-D5	A	9	Rad	D	260	2300	S.L.	80	516	1.98	4⅝x4½	680.4	6.50	131	—	19¾	43½	37	.55	.025	prr		BG	DM	Sc	Ag	Eo	No	1025	873	
Jacobs Aircraft Engine Co.	L-4	A	7	Rad	D	225	2000	S.L.	73	480	2.13	5¼x5	757.0	5.38	118	—	16½	43½	36⅜	.55	.018	prr	Al,S	BG	2Bat	Se	Ag	Eo	No	774	621	
Jacobs Aircraft Engine Co.	L-4M	A	7	Rad	D	225	2000	S.L.	73	473	2.10	5¼x5	757.0	5.38	118	—	16½	43½	36⅜	.55	.018	prr	Al,S	BG	2M	Sc	Ag	Eo	No	779	621	
Jacobs Aircraft Engine Co.	L-4MB	A	7	Rad	D	225	2000	S.L.	73	494	2.20	5¼x5	757.0	5.38	118	—	16½	43½	36⅜	.55	.018	prr.	Al,S	BG	1M 1Bat	Sc	Ag	Eo	No	894	721	
Jacobs Aircraft Engine Co.	L-4MA2	A	7	Rad	D	225	2000	S.L.	73	476	2.12	5¼x5	757.0	5.38	118	—	16½	43½	36⅜	.55	.018	prr	Al,S	BG	2M	Se	Ag	Eo	No	803	621	
Jacobs Aircraft Engine Co.	L-5	A	7	Rad	D	285	2000	S.L.	73	510	1.79	5½x5	831.0	6.00	136	—	16½	43½	36⅜	.53	.018	prr	Al,S	BG	2Bat	Se	Ag	Eo	No	889	756	
Jacobs Aircraft Engine Co.	L-5M	A	7	Rad	D	285	2000	S.L.	73	504	1.77	5½x5	831.0	6.00	136	—	16½	43½	36⅜	.53	.018	prr	Al,S	BG	2M	Sc	Ag	Eo	No	814	756	
Jacobs Aircraft Engine Co.	L-5MB	A	7	Rad	D	285	2000	S.L.	73	525	1.84	5½x5	831.0	6.00	136	—	16½	43½	36⅜	.53	.018	prr	Al,S	BG	1M 1Bat	Sc	Ag	Eo	No	996	756	
Jacobs Aircraft Engine Co.	L-5MA7	A	7	Rad	D	285	2000	S.L.	73	510	1.79	5½x5	831.0	6.00	136	—	16½	43½	36⅜	.53	.018	prr	Al,S	BG	2M	Se	Ag	Eo	No	919	756	
Jacobs Aircraft Engine Co.	L-5C	A	7	Rad	D	.....	.....	S.L.	73	.....	.....	5½x5½	914.0	—	—	—	16½	45⅝	38⅛	—	—	prr	Al,S	BG	2Bat	Sc	Ag	Eo	No	—	—	
Jacobs Aircraft Engine Co.	L-5CM	A	7	Rad	D	.....	.....	S.L.	73	.....	.....	5½x5½	914.0	—	—	—	16½	45⅝	38⅛	—	—	prr	Al,S	BG	2M	Se	Ag	Eo	No	—	—	
Jacobs Aircraft Engine Co.	L-5CMB	A	7	Rad	D	.....	.....	S.L.	73	.....	.....	5½x5½	914.0	—	—	—	16½	45⅝	38⅛	—	—	prr	Al,S	BG	1M 1Bat	Se	Ag	Eo	No	—	—	
Menasco Mfg. Co.	B4-Pirate	A	4	Lid	D	95	2000	S.L.	73	290	3.05	4½x5¼	326.0	5.50	115	—	11⅝	28⅝	47'3⅛	.54	.006	prr	Al,NI	BG	2M	B,Se	Ag	Eo	No	675	65	
Menasco Mfg. Co.	C4-Pirate	A	4	Lid	D	125	2175	S.L.	73	293	2.34	4½x5¼	363.0	5.50	125	—	11⅝	28⅝	47'3⅛	.50	.010	prr	Al,NI	BG	2M	B,Se	Ag	Eo	No	675	65	
Menasco Mfg. Co.	C4S-Pirate	A	4	Lid	D	150	2260	3000	80	305	2.03	4½x5¼	363.0	5.50	144	9.40	11⅝	28⅝	47'3⅛	.47	.025	prr	Al,NI	BG	2M	B,Se	Ag	Eo	No	690	134	
Menasco Mfg. Co.	B6-Buccaneer	A	6	Lid	D	160	1975	S.L.	73	385	2.40	4½x5¼	489.0	5.50	131	—	11⅞	28⅝	58'½	.55	.006	prr	Al,NI	BG	2M	B	Ag	Eo	No	666	66	
Menasco Mfg. Co.	B6S-Buccaneer	A	6	Lid	D	200	2250	4500	80	423	2.11	4½x5¼	489.0	5.50	146	8.75	11⅞	28⅝	60⅛	.52	.025	prr	Al,NI	BG	2M	B	Ag	Eo	No	708	79	
Menasco Mfg. Co.	C6S-4 Super Buccaneer	A	6	Lid	D	[12]250	2300	5000	80	535	2.14	4½x5¼	544.9	5.50	158	10.90	12⅞	30⅛	71⅛	.55	.025	prr	Al,S	BG	2M	Se	Ag	Eo	No	875	746	
Pratt & Whitney Aircraft	Wasp, Jr. SB	A	9	Rad	D	[14]400	2200	5000	80	[14]640	1.42	5¼x5¼	985.0	6.00	157	10.00	23⅛	45¾	41'3⅛	.48[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	13	
Pratt & Whitney Aircraft	Wasp, Jr. TB	A	9	Rad	D	[14]420	2200	S.L.	80	[14]640	1.52	5¼x5¼	985.0	6.00	154	8.00	23⅛	45¾	41'3⅛	.48[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	15	
Pratt & Whitney Aircraft	Wasp, Jr. SC-G	A	9	Rad	G1	[17]525	2700	9500	87	[14]876	1.45	5¼x5¼	985.0	6.70	169	8.70	23⅛	46¾	45'3⅛	.46[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	746	
Pratt & Whitney Aircraft	Wasp 82H-1	A	9	Rad	D[26]	500	2200	10500	80	[14]855	1.70	5¾x5¾	1344.0	6.00	134	12.00	23⅛	51⅞	44⅝	.48[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	165	
Pratt & Whitney Aircraft	Wasp 83H-1	A	9	Rad	D[26]	[18]550	2200	5000	80	[14]855	1.42	5¾x5¾	1344.0	6.00	157	10.00	23⅛	51⅞	44⅝	.48[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	165	
Pratt & Whitney Aircraft	Wasp T1H-1	A	9	Rad	D	550	2100	S.L.	80	[14]855	1.55	5¾x5¾	1344.0	6.00	153	10.00	23⅛	51⅞	44⅝	.48[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	165	
Pratt & Whitney Aircraft	Wasp 81H1-G	A	9	Rad	G1	[18]550	2200	8000	87	[14]930	1.52	5¾x5¾	1344.0	6.00	157	12.00	23⅛	51⅞	48⅞	.46[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	178	
Pratt & Whitney Aircraft	Hornet 85E	A	9	Rad	D	700	2050	6000	87	[14]968	1.58	6¼x6½	1690.0	6.50	160	12.00	23⅛	54⅞	45'3½	.48[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	184	
Pratt & Whitney Aircraft	Hornet 81E-G	A	9	Rad	G1	[20]750	2250	7000	87	[14]1068	1.23	6¼x6½	1690.0	6.50	179	12.00	23⅛	54⅞	49⅝	.48[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	236	
Pratt & Whitney Aircraft	Hornet 813E-G	A	9	Rad	G1	[21]750	2250	4000	87	[14]1068	1.34	6¼x6½	1690.0	6.50	163	10.00	23⅛	54⅞	49⅝	.48[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	236	
Pratt & Whitney Aircraft	Twin Wasp, Jr. SB4-G	A	14	Rad-s	G1-2	[22]750	2550	9000	87	[14]1116	1.37	5¼x5¼	1535.0	6.75	162	11.00	23⅛	44⅛	53¼	.46[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	236	
Pratt & Whitney Aircraft	Twin Wasp SB3-G	A	14	Rad-s	G1	[23]900	2450	6500	87	[14]1300	1.30	5½x5½	1830.0	6.70	166	12.00	23⅛	48	55⅜	.46[24]	.025[25]	prr	Al,S	Op	2M	Se	Ag	Op	No	—	236	
Ranger Engineering Corp.	6-390 D-4	A	6	Lid	D	150	2350	S.L.	80	355	2.36	4x5½	386.4	6.50	131	—	—37	31'5⅛	50⅛	.50[9]	.015	ohc	Al,S	BG	M	Se	Ag	Op	No	—	165	
Ranger Engineering Corp.	6-410 B-1	A	6	Lid	D	165	2450	S.L.	80	355	2.15	4⅛x5⅜	410.9	6.50	130	—	—37	31'5⅛	50⅛	.50	.015	ohc	Al,S	BG	M	Se	Ag	Op	No	—	165	
Ranger Engineering Corp.	V-770 B-4	A	12	Vld	D	305	2300	S.L.	80	565	1.85	4x5½	772.8	6.50	136	—	15⅜	27⅝	61	.50	.015	ohe	Al,S	BG	M	Se	Ag	Op	No	—	305	
Ranger Engineering Corp.	SGV-770 B-5	A	12	Vld	G1	420	2800	3000	87	640	1.52	4x5½	772.8	6.00	154	8.84	—38	32¼	61⅝	.49	.025	ohe	Al,S	BG	M	Se	Ag	Op	No	1062	885	
Wright Aeronautical Corp.	R-760-E1	A	7	Rad	D	285	2100	S.L.	73	565	1.90	5x5½	756.0	6.10	142	7.05	19¼	45	42¾	.55	.020	prr	Al,S	BG	2M	Se	Ag	Op	Yes	1035	835	
Wright Aeronautical Corp.	R-760-E2	A	7	Rad	D	320	2200	S.L.	80	570	1.75	5x5½	756.0	6.30	152	9.17	19¼	45	42¾	.55	.020	prr	Al,S	BG	2M	Se	Ag	Op	Yes	1035	835	
Wright Aeronautical Corp.	R-760-ET	A	7	Rad	D	235	2000	S.L.	73	515	2.20	5x5½	756.0	6.10	123	—	19¼	45	42¾	.55	.020	prr	Al,S	BG	2M	Se	Ag	Op	Yes	1000	85	
Wright Aeronautical Corp.	R-975-E1	A	9	Rad	D	365	2100	S.L.	73	660	1.75	5x5½	973.0	6.10	141	7.80	19¼	45	43½	.55	.020	prr	Al,S	BG	2M	Se	Ag	Op	No	1400	1225	
Wright Aeronautical Corp.	R-975-E3	A	9	Rad	D	420	2200	1400	80	675	1.57	5x5½	973.0	6.30	155	10.15	19¼	45	43½	.55	.020	prr	Al,S	BG	2M	Se	Ag	Op	Yes	1400	1225	
Wright Aeronautical Corp.	R-1820-F52	A	9	Rad	D	775	2100	5800	87	990	1.25	6¼x6⅞	1823.0	6.40	160	7.00	23⅛	54⅛	43⅝	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1760	1535	
Wright Aeronautical Corp.	GR-1820-F52	A	9	Rad	G3	760	2100	5800	87	1085	1.41	6¼x6⅞	1823.0	6.40	157	7.00	23⅛	54⅛	47⅛	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1760	1535	
Wright Aeronautical Corp.	R-1820-F53	A	9	Rad	D	745	2100	9600	87	990	1.31	6¼x6⅞	1823.0	6.40	154	8.31	23⅛	54⅛	43⅝	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1760	1535	
Wright Aeronautical Corp.	GR-1820-F53	A	9	Rad	G3	730	2100	9600	87	1085	1.47	6¼x6⅞	1823.0	6.40	151	8.31	23⅛	54⅛	47⅝	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1760	1535	
Wright Aeronautical Corp.	R-1820-F54	A	9	Rad	D	690	2100	15300	87	990	1.41	6¼x6⅞	1823.0	6.40	142	10.00	23⅛	54⅛	43⅝	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1760	1535	
Wright Aeronautical Corp.	GR-1820-F54	A	9	Rad	G3	675	2100	15300	87	1085	1.59	6¼x6⅞	1823.0	6.40	139	10.00	23⅛	54⅛	47⅛	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1760	1535	
Wright Aeronautical Corp.	R-1820-F56	A	9	Rad	D	755	2100	11300	87	990	1.29	6¼x6⅞	1823.0	6.40	156	8.83	23⅛	54⅛	43⅝	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1760	1535	
Wright Aeronautical Corp.	GR-1820-F56	A	9	Rad	G3	740	2100	11300	87	1085	1.45	6¼x6⅞	1823.0	6.40	153	8.83	23⅛	54⅛	47⅛	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1760	1535	
Wright Aeronautical Corp.	GR-1820-F62	A	9	Rad	G3	760	2100	5800	87	1085	1.41	6¼x6⅞	1823.0	6.40	157	7.00	23⅛	54⅛	47⅛	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1760	1535	
Wright Aeronautical Corp.	GR-1820-G2	A	9	Rad	G3	850	2100	5800	87	1183	1.40	6¼x6⅞	1823.0	6.45	176	7.00	23⅛	54⅛	47⅛	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1950	1757	
Wright Aeronautical Corp.	GR-1820-G3	A	9	Rad	G3	840	2100	8700	87	1183	1.40	6¼x6⅞	1823.0	6.45	173	8.31	23⅛	54⅛	47⅛	.60	.025	prr	Al,S	BG	2M	Se	Ag	Op	No	1950	1757	

Footnotes

A —Air cooled
Al —Aluminum
Apl —Applied for
B —Bosch
Bat —Battery ignition
Be —Berling
C —Cast Iron
CG —Chandler-Groves
Ch —Champion
D —Direct
DM —Dual magneto
Ec —Eclipse
ES —Edison Splitdorf
G —Geared
G1 —3:2 reduction gear
G2 —4:3 reduction gear
G3 —16:11 reduction gear
G4 —7:5 reduction gear
G5 —2:1 reduction gear
H —Horizontal
Hy —Holley
Id —Inverted
L —Cylinders in line
Lh —"L" head
M —Magneto
NI —Nickel iron
Op —Optional
Opp —Opposed
Ohe —Overhead cam
Pdg —Pending
prr —Push rods and rocker arms
Rad —Radial
Rad S —Staggered radial
S.L. —Sea Level
Se —Scintilla
Sg —Stromberg
S —Steel
V —Vee
W —Liquid cooled
Z —Zenith

* All engines, unless otherwise specified, equipped with single intake valve.
1. Weight applies to sample engine made from wood patterns, and weight reduction will be expected from production engines from metal patterns.
2. Two intake valves per cylinder.
3. Weight includes propeller hub rear flange (integral with crank shaft).
4. 8½ in. x 10¾ in. long.
5. At cruising speed.
6. Cast iron alloy.
7. Provision for two magnetos.
8. 8½ in. horizontal; 10⅝ in. vertical.
9. 7 in. wide upper, 10½ in. wide lower, 11⅜ in. high.
10. Diesel fuel.
11. Marvel Injector.
12. Takeoff 290 hp. at 2400 r.p.m. 87 octane fuel.
13. 8½ horizontal top, 9½ horizontal bottom, 10¾ vertical, 4 bolts in rear of crankcase.
14. This weight includes all standard running equipment.
15. 450 hp. at 2300 r.p.m. for takeoff on 87 octane fuel.
16. 440 hp. at 2300 r.p.m. for takeoff on 87 octane fuel.
17. 600 hp. (100 octane) or 575 hp. (87 octane) at 2850 r.p.m. for takeoff
18. 600 hp. (87 octane) at 2250 r.p.m. for takeoff.
19. 600 hp. at 2250 r.p.m. for takeoff.
20. 875 hp. at 2300 r.p.m. for takeoff.
21. 800 hp. at 2300 r.p.m. for takeoff.
22. 825 hp. at 2625 r.p.m. for takeoff.
23. 1000 hp. at 2600 r.p.m. for takeoff.
24. At cruising hp.
25. Max. at rated power.
26. Available with 3:2 reduction gear.
27. 15 in. front, 17 in. rear.
28. 15⅝ in. front, 19⅝ in. rear.



Vega's First Model

Preliminary details of 5-6 place plane designed for UniTwin Power Plant

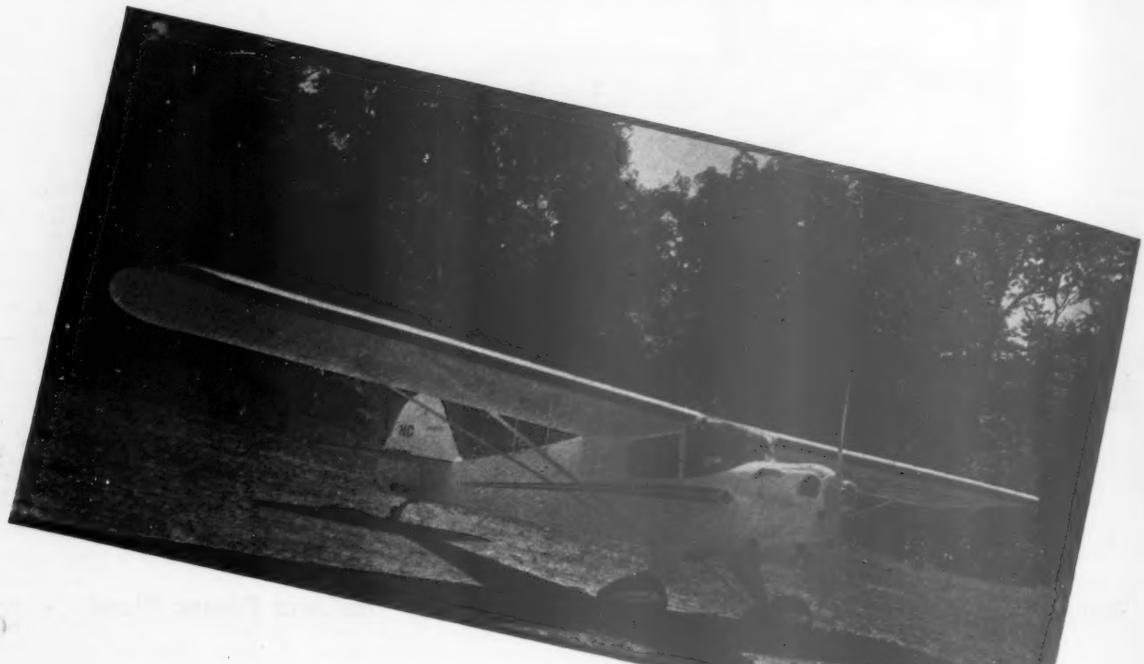
DETAILS OF THE NEW VEGA airplane have recently been made public for the first time. Mac Short, president of the Vega Airplane Company, subsidiary of the Lockheed Aircraft Corporation, calls attention in his announcement to the significant feature of the design, the UniTwin engine installation. This type power plant has been under development, in conjunction with the Menasco Manufacturing Company, for more than three years. Basic feature is dual mounting of two Menasco 260 h.p. engines to drive a single propeller.

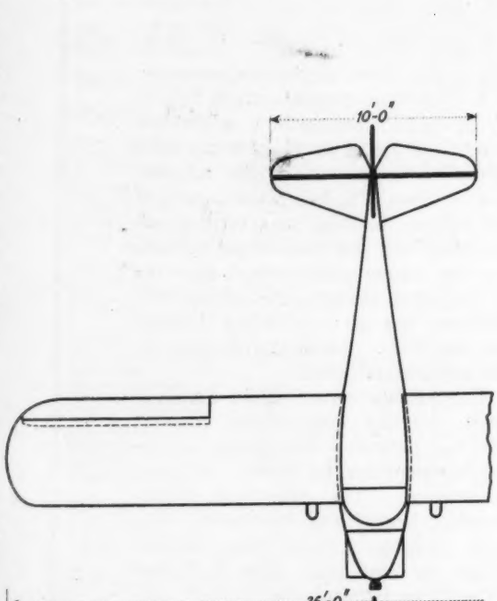
Other features of the Vega airplane closely follow the general trend of the Lockheed transports produced by the parent company, utilizing twin rudder tail arrangement, trailing edge wing flaps, and other advanced aerodynamic features. The Vega airplane, however, is designed to reach the private owner market more than that of the airlines, although a feature of the design is its suitability for use as a "starliner" on the new feeder routes now in prospect to supplement the established major air transport lines. The Vega is a low wing monoplane with accommodations for five to six persons. Metal structure is used throughout and the twin-engine powerplant is mounted in the nose of the fuselage. Wing span of the plane is 41 ft., length 31 ft. 5½ in., height 9 ft. 1 in., and estimated gross weight 5411 lbs. Tricycle landing gear of retractable type will be a feature of the plane. General lines and cabin arrangement are particularly attractive as illustrated by design drawings, showing a strong automotive influence. The UniTwin power plant mounts the two Menasco C6S4 six-cylinder aircraft engines side by side driving a single constant-speed propeller through a new type gearing incorporating over-running clutches. This drive eliminates any need of close synchronization of the engines and provides an automatic release of either engine in case of trouble or sudden stoppage, permitting the live engine to continue driving the propeller without having to work against the inertia of the dead engine and without subjecting the airplane to the unbalanced control forces of offset live and dead engines. Through mounting both engines within the fuselage the wing-nacelle drag of the ordinary twin engine airplane is completely eliminated.

The fuselage structure of the Vega is of two types. The forward section consists of a welded steel tube structure to which is mounted the aluminum alloy cabin shell. Aft of the cabin the fuselage is of semi-moncoque sheet aluminum alloy construction. The metal wing is built in two main panels, each bolted directly to the fuselage truss structure, thus eliminating the center section unit entirely.

A split type center section flap is of all-metal construction while the wing flaps are of metal structure with fabric covering, as are the ailerons and elevator. The two main wheels of the tricycle landing gear retract into the wing and the nose wheel retracts into the engine compartment, but even in retracted position the wheels still function for an emergency landing on the belly, preventing damage to the airplane structure.

The private owner cabin arrangement provides commodious comfort for five persons. The feeder airline version provides for a pilot and five passengers. The cabin is soundproofed, heated and ventilated. The main baggage compartment, located below the rear seats, may be loaded through an exterior door. Mail compartments are provided in the wing adjacent to the cabin. Although no performance data are available at this time Mac Short indicates that the Vega will have a top speed in excess of 200 miles per hour and a cruising range of about 1000 miles. Flight tests on the first plane of this type are scheduled for January, 1939.





TAYLORCRAFT 50

Continental, Franklin, Lycoming, and other engine installations now available. Others to follow.

THREE ENGINE INSTALLATIONS are available in the new Taylorcraft 50 recently introduced by Taylor Young. Model BC uses the Continental A-50; Model BF, the Franklin 50, and Model A, the Continental 40 hp. engine. A Lycoming installation is also available.

The many improvements in the new model include a more sensitive control action and an arrangement of controls to provide a perfectly clear floor space in the cabin. A new type of trimming tab has been introduced. It is ineffective at slow speeds but provides excellent balance under cruising conditions. Fuel capacity has been increased to 12 gallons. The windshield has been broadened to improve visibility. Structural strength has been generally increased.

Specifications furnished by the manufacturer are as follows: Take-off run, 400 ft.; landing speed, 35 m.p.h.; climb, first minute, 450 ft.; top speed, 97 m.p.h.; cruising speed, 88 m.p.h.; safe cruising range, 275 miles; absolute ceiling, 15,000 ft.; fuel consumption, 3½ g.p.h.; oil consumption, ¼-pt. per hr.; fuel capacity, 12 gal.; oil capacity, 4 quarts; span, 36 ft.; length, 22 ft.; height, 6 ft. 8 in.; empty weight, 632 lb.; useful load, 468 lb.; pay load, 218 lb.; gross weight, 1,000 lb.; baggage allowance, 30 lb.; accessory allowance, 18 lb.

Flying Equipment

MILITARY NORSEMAN

5-6 pilots can be trained in modified Noorduyn model

TO INSTRUCT 5 or 6 pilots all aboard the same aircraft the Noorduyn Norseman has been converted to suit the requirements of the Canadian Department of National Defense. Training in the use of the latest R.A.F. navigation, bombing, signalling and communication equipment is provided. Modifications include installation of a blind flying instrument panel, a course setting bomb sight in the belly of the ship with a curved Perspex panel in the fairing, signalling lights and observers' compass mountings in the door windows. The transport features of the standard model are retained in the trainer which is also suited for use in ambulance service.

Complete radio equipment is installed in the rear of the cabin. An electrically operated rack for dropping flares or practice bombs is also installed.

Specifications furnished by the manufacturer are as follows: span overall, 51 ft. 6 in.; weight empty, landplane 4010 lb.; seaplane, 4477 lb.; gross weight, landplane or seaplane, 6450 lb.; high speed at 5000 ft., landplane, 170 m.p.h.; seaplane, 154 m.p.h.; service ceiling, landplane, 22,000 ft.; seaplane, 20,000 ft.; range with standard tanks of 105 imp. gal., landplane, 600 mi.; seaplane, 550 mi.

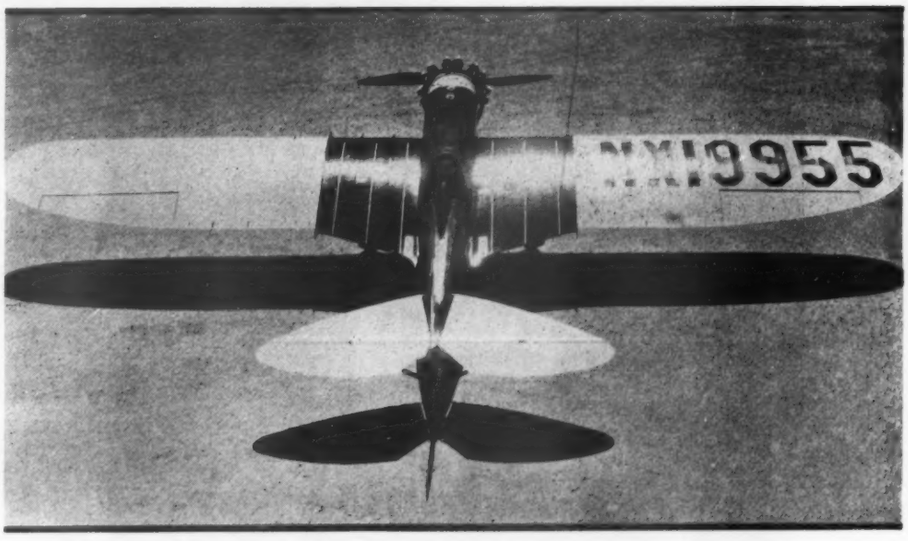
Specifications as furnished by the designer are as follows: Span (maximum) 32 ft.; Span (minimum) 24 ft. (possible 20 ft.); Chord (mean), 67 in.; Wing area 164.7 sq.ft.; Length, 16 ft. 6 in.; Weight empty, 932 lb.; Estimated high speed (extended), 110 m.p.h.; Estimated high speed (retracted), 165 m.p.h.; Landing speed, 38 m.p.h.

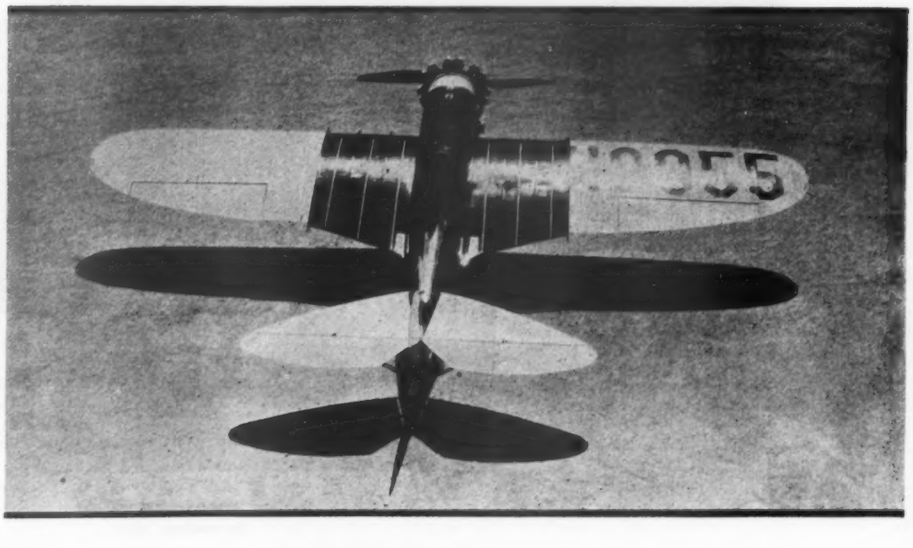
For multiple pilot training, the new Norseman

CON ELLINGSTON SPECIAL

Retractable wing provides increase in estimated performance.

TEST FLIGHTS have been under way at Helena, Mont., on a retractable wing monoplane having an estimated top speed of 165 m.p.h. with wings and wheels retracted and 110 m.p.h. in the extended positions. Structure of the Con Ellingston Special is conventional except for the retractable wing features. Spars of tubular construction, using 4130 chrome molybdenum steel tubing and wire bracing. A Clary Y airfoil section is employed. Power plant embodies the 90 hp. LeBlond engine.





Con Ellingston special with wings extended (above), retracted (below).

EASTERN AIR LINES FLIES OF GOODRICH DE-ICERS,

"NO PARKING" FOR ICE

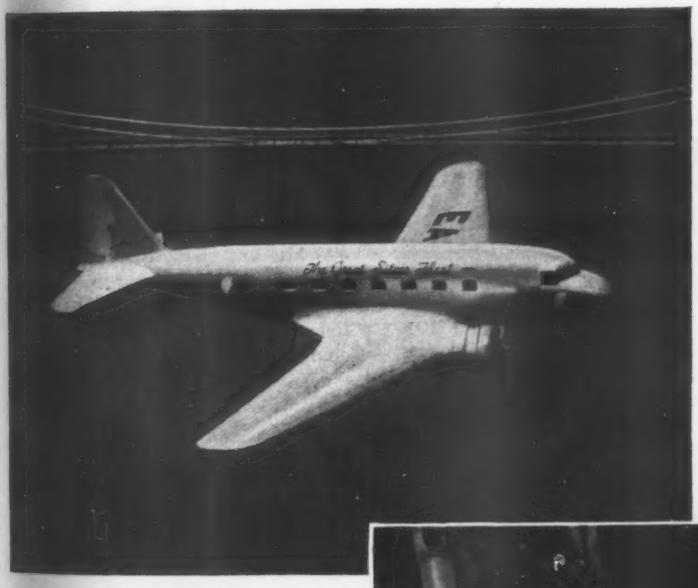
(Above), an Eastern Air Lines' giant is made ready for winter and high altitude flying as mechanics attach the Goodrich DE-ICER to wings. At the flick of a switch these huge pulsating rubber "shoes" go into action—cracking and breaking ice from wing edges as fast as it forms. *(At right)* Ice gets no chance to loiter on propellers because this Goodrich-developed "spinner" and "slinger ring" assembly constantly bathes the blades with an ice-defying solution.

SAFE CUSHIONING FOR A 12-TON "AIR GIANT"

"Eastern's" fast schedules and operating conditions require the best in tires. Day in and day out these Goodrich Airplane Silvertowns are called upon to land 12-ton planes smoothly and safely on everything from snow-crusted fields of the north to sunny sands of the south.

WITH THE 3-WAY SAFETY TIRES AND E.T.* BRAKES

Goodrich Products Hold Important Jobs in Maintaining Eastern Air Lines High Safety Standard



FOR ten years Eastern Air Lines planes have flown with Goodrich Tires. On millions of passenger miles flown "Eastern" planes have been protected by Goodrich DE-ICERS. And now this forward-looking organization—alert to every new development for safety and comfort—adds Goodrich *Expander Tube* Brakes to make its landings safer, smoother than ever.

Remember, the dependability of Goodrich Aviation Products in the routine service of the world's leading pilots, plane makers and air lines is overwhelming proof that *it pays to specify* Goodrich. Write Dept. 671, Aeronautical Division of The B. F. Goodrich Co., Akron, Ohio, for complete information about Goodrich Airplane Silvertowns, Goodrich DE-ICERS, the new Goodrich E.T.* Brakes and over 40 other Goodrich Aviation Products for military, private and commercial planes. Ask for a copy of "Goodrich In Aviation."

*EXPANDER TUBE

Now Eastern Air Lines Gets Smoother Stopping On All Types Of Landing Terrain

• The smoothest stopping offered on planes today! That's an *extra* comfort Eastern's passengers get—thanks to the new Goodrich E.T.* Brakes. A full circle of individually articulated brake blocks forced against the brake drum by the Goodrich *Expander Tube* give uniform pressure at all times—enable this brake to *automatically adjust itself for lining wear.* If you want smoother braking with less maintenance cost, equip your planes with Goodrich Expander Tube Brakes now.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

Goodrich *Airplane* Silvertowns

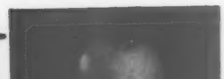
THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — DE-ICERS — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete Line of Rubber Aeronautical Accessories.

AVIATION

RADIO

Dialing the Air Waves with Don Fink



Absolute Altitude

Long sought-for measurement of height above ground indicated by new radio device developed jointly by U.A.L. and Western Electric.

ON OCTOBER 9TH, the aviation editors of the newspapers and the technical press were given their first glimpse of an instrument long awaited by the industry, an altimeter which indicates height above ground rather than height above sea level. The new instrument, developed jointly by engineers of the Bell Telephone Labs and the United Airlines, is appraised for its effect on aviation generally by Dan Sayre, on page 55 of this issue. In this department we content ourselves with some of the technical background.

The development is a milestone in aviation radio, and in any kind of radio for that matter, since it employs the shortest wavelengths yet put to practical application, 0.6 meter or 60 centimeters. Aircraft radio engineers were startled not so many months ago when it became apparent that marker beacons, airport boundary markers, and the like would operate at frequencies of 75 megacycles. The new altimeter goes this record nearly eight times better, that is, to 500 Mc.

The technical information given out at the demonstration is rather meager. The following are definitely known facts: the transmitter operates in the neighborhood of 500 Mc, at a power output of about 5 watts, a power sufficient to give altitude indications as high as 4,000 to 5,000 feet. The signal is generated in a negative-grid oscillator (similar to the oscillators employed in conventional work but capable of operating at much higher frequencies). The signal is radiated from a small dipole antenna mounted under the metal surface of the wing. Each element of the dipole is about 6 inches long and the clearance between the elements and the wing surface is about the same distance. The signal, because of its very high frequency, has highly directional properties, and is transmitted beam fashion to the ground below, where it is reflected upward. The short wavelengths employed experience a high degree of reflection from any surface, whether it be by water, level terrain, mountains, or even man-made structures, such as buildings and bridges.

Peter Sandretto, right, explains the UAL-Western Electric altimeter to P. M. Pincomb, UAL pilot

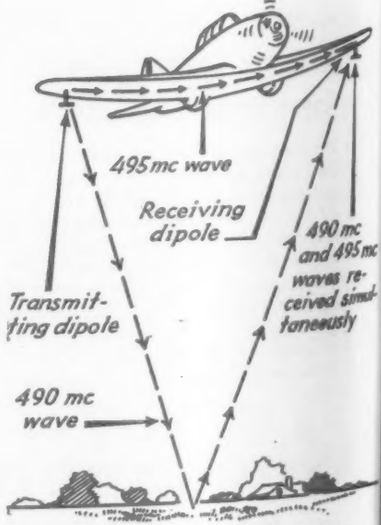
The signal upon reflection from the ground is received by another dipole antenna, exactly similar to the first, mounted underneath the opposite wing. This second dipole also receives a small signal directly from the transmitting dipole opposite. The time difference between the arrivals of these two waves is then a direct measure of the time during which the reflected waves have traveled from plane to earth. Since the velocity of wave travel is known, it is then simple to compute the distance traveled by the wave and hence the distance of the plane above the reflecting object.

At first glance, the proposition seems simple, but not when the velocity at which radio waves travel is considered. This velocity is 2.998 x 10^{10} cm. per sec. or roughly 186,000 miles per second. At an altitude of one-half mile, (total reflected distance one mile) the time difference between the arrivals of the two waves is 1/186,000 of a second. It is obviously impossible to measure any such time interval directly with any known timing device. The measurement must therefore be made indirectly. What method is used was not revealed by the companies involved.

It is possible to make an "educated guess" as to the method employed which may come not far from the truth. The explanation given below has no official confirmation, but will serve until more details are available:

While it is impossible to measure very small time intervals directly, it is quite possible to measure small frequency differences. Suppose therefore that a frequency-modulated wave is transmitted from the transmitting dipole under the wing of the plane. By frequency modulated is meant a wave whose frequency is continually varied between two limits, say between 490 Mc. and 510 Mc., in such a way that the increase and decrease of frequency between 490 and 510 is made linear with respect to time. Then any change in frequency is proportioned to a corresponding change in time.

Suppose further that a wave starts out from the dipole at 490 Mc. and travels to the earth, is reflected and appears at the receiving dipole. During the flight of this wave, the trans-



Illustrating the frequency-modulation method of absolute altimetering

mitted frequency changes so that by the time the reflected 490 Mc. wave is received, the frequency then being transmitted is, say, 495 Mc. This 495 Mc. wave travels directly under the wing and is received, together with the 490 Mc. reflected wave. The two received waves may then be detected by a receiver in whose output appears a beat frequency which is the difference between the two received waves or 495 — 490 = 5 Mc. This frequency difference is indicated on a direct-reading frequency meter.

Suppose now that the plane climbs to twice its former altitude. The reflected wave takes twice as much time in arriving at the receiving dipole and the transmitted frequency has the opportunity to change twice as much, that is to 500 Mc. The difference between the reflected frequency and the "under-wing" frequency is then 10 Mc. and this produces twice as great

(*Turn to page 80*)

"Index Finger" D-F

Sperry-RCA direction finder points automatically and continuously to tuned-in station.

A RADIO DIRECTION FINDER completely automatic in operation has long been desired by pilots already burdened with too many dials to watch and too many knobs to turn. The answer to this need has recently been made available by the Sperry Gyroscope Company and the RCA Manufacturing Company who have cooperated in the development of an automatic direction finder which might be called a "d-f with a college education." The operation of the device, from the pilot's point of view, is extremely simple. He tunes in the desired station, and at once the arrow on a pointer mounted above an azimuth scale swings to the direction from which the signal is coming, stops and holds that direction regardless of the plane's maneuvers. The device completely eliminates the 180° ambiguity usual in radio compass work. The indicated direction can be transferred directly to navigation charts for determining the position of the plane or employed to check drift and ground speed. Little more than this can be asked of a direction finder, little at least which lies within the province of engineering development. Even the troublesome night-effect is to some extent minimized by the device, since the indicating needle swings, under night-effect conditions, over a sector whose bisector is very nearly the true direction to the station.

Behind this achievement lies a very simple principle and a long period of engineering work devoted to removing the bugs with which "simple principles" are always infested. The end point of the development may be seen in the accompanying photograph of an installation of the Sperry-RCA equipment on a DC-3 of the American Airlines. Between the two pilots, and just aft of the throttle column (center foreground), is a small box with a horizontal glass face and four knobs, together with two other knobs and toggle switches on the side of the housing. Beneath the glass face is the compass card, consisting of two separate scale rings graduated in degrees. One ring is fixed with the zero pointing to the head of the ship. as shown in the diagram. The other is adjustable and is used to set the course of the plane as indicated by the magnetic compass or directional gyro. Over the center of the card is a pointer, with an arow head at one end. The arrow points in the direction of the station being received, with an accuracy of from less than one degree to five degrees depending on signal strength and wave-front distortions due to night-effect. The inherent accuracy of the mechanism is about one-quarter of a degree.

The knobs include remote controls of the d-f receiver; they control volume, band-switching (two bands, the beacon band and the broadcast band, are available), tuning, connect and disconnect the sense antenna, and select the function of the D-F for fully automatic, or manual operation.

(*Turn to page 80*)

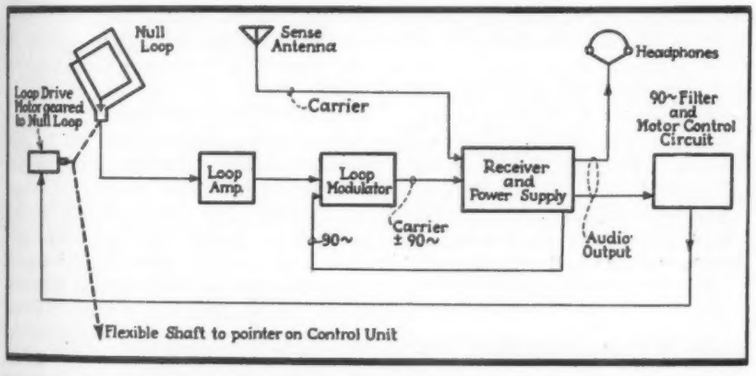


Diagram of the Sperry-RCA automatic follow-up d-f

AA's Superintendent of Communications Flynn tells Pilot Dum (left) how the Sperry gadget works

Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

Rim Lighted Split Case

Is new feature of Kollsman Sensitive Altimeter

HIGH ALTITUDE OPERATING TECHNIQUES have brought increased need for aircraft instruments in which case leakage is completely eliminated. To meet this need and also to provide a wider angle of vision of the dial in the newer large cockpits of transport aircraft, the latest Kollsman Sensitive Altimeter, type 370 and Air Speed Indicator, Type 386, feature split cases with rim lighting.

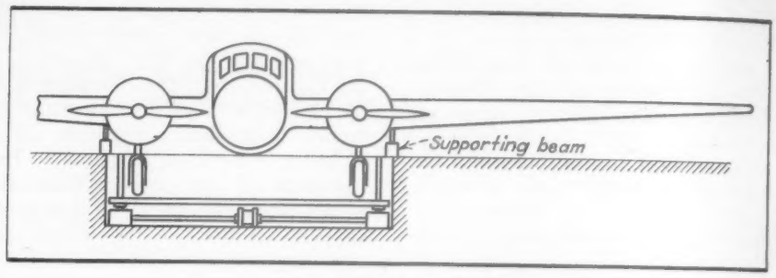
The new instruments have the same mechanism and performance characteristics as their predecessors, but instead of having the conventional case, with glass held in by a snap ring, the glass is held in a retaining ring which is secured to the case by eight screws. It is claimed that this construction provides a better seal and reduces the possibility of case leakage, which should be of value in flying at high altitudes and in pressurized aircraft.

Since the glass is made larger in diameter than the dial the complete length of the graduations is visible, even when viewed from an extreme angle, which is a decided advantage where one instrument is used by two pilots. The well-known uniform lighting obtained with Kollsman Rim Lighting is retained with this type mounting.—AVIATION, *November, 1938.*

Drop Pit Table

New maintenance device speeds servicing operations

ONE OF THE FAVORITE INDOOR SPORTS of airline maintenance men has been the devising of trick platforms and ladders by means of which personnel may inspect and service all parts of an airplane, no matter how high off the hangar floor. But now comes word of an interesting reversal of this process, by means of which the airplane is dropped through the floor (or at least partially into a pit) so that the wings and upper fuselage surfaces become accessible without the use of high platforms. Known as the Whiting Drop Pit Table, the new equipmen is offered by the Whiting Corp., of Harvey, Illinois, manufacturers of drop pit tables for many years. The Whiting equipment has been designed to handle planes of tri-cycle gear type as well as those with conventional landing gear. The Whiting Drop Pit Table equipment may readily be used or wheel changes or other landing gear work, as well as for the normal maintenance work on the plane itself. —AVIATION, *November, 1938.*

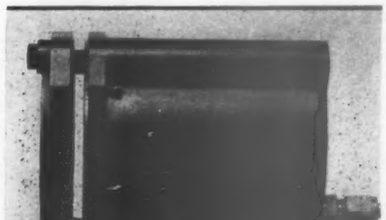


Drop Pit Table for Airplanes.

Junior Xacto Meter

Measures fuel flow and weighs only 12½ lb.

BEFORE fuel consumption can be reduced the exact rate must be determined. So the need for a small, light-weight liquid meter to accurately determine exact flow rates of small volumes of fluid became recognized, and to fill this need the S. F. Bowser and Company organization developed the aircraft type Xacto Meter. Now a further refinement of this meter, the Junior Xacto Meter, has been perfected. Weighing but 12½ lb. including the recording instrument, the Junior Xacto Meter will measure to within one-half of one per cent the flow of fuel over a range of from ten to one hundred gallons per hour, making the instrument applicable to a wide range of aircraft. The Junior Xacto Meter is built to aircraft standards throughout, with safetied screws and rugged mounting pad to permit rigid installation. A manually operated bypass permits free flow of fuel whenever the pilot wishes, as on take-off.—AVIATION, *November, 1938.*

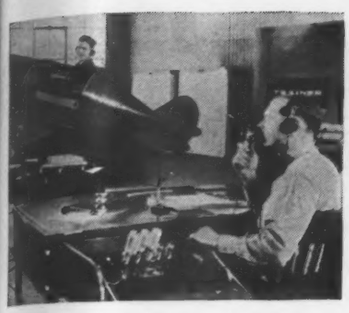


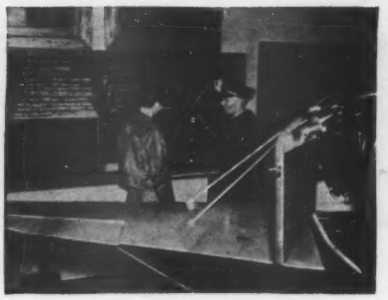
Kollsman Sensitive Altimeter with new rim-lighted split case.

Weight Estimator

For sheet metal works like a slide rule

ONE OF THE ROUTINE OPERATIONS which consumes much time for engineers, purchasing agents, estimators, draftsmen, and others who must work with flat sheet metals, is estimating the weight of metal sheets of various dimensions and thicknesses. To offset this mental labor a slide rule for flat materials has been developed by the Dayton Rogers Manufacturing Company, of Minneapolis, Minn., and will be forwarded without charge to anyone writing direct for it. This rule will give the correct weight instantly of steel, aluminum, cast iron, copper, bronze and lead, in widths from ¼ in. to 96 in., in thicknesses from .002 in. to 25 in., and in lengths from one-inch to 1,000 feet. Results may be read in weights from .1 lb. to 10,000 lb.—AVIATION, *November, 1938.*





WILL HELP YOU TO PASS THE OFFICIAL TESTS FOR ANY PILOT RATING

Just Published— on Primary and Advanced Training

"Air Piloting Manual of Flight Instruction"

By VIRGIL SIMMONS,

Formerly Flying Instructor at Boeing School of Aeronautics and in U. S. Army and Navy Air Services.

300 Pages, 75 Illustrations, Price $3.00

WRITTEN to help its users meet the latest government requirements—*the Civil Air Regulations issued May 31, 1938*—this new book supplies in detail the flight training instructions needed by beginners and also by pilots, already proficient, who aspire to attain higher grades. In addition it will be helpful to flying instructors and to pilots who wish to obtain the instructor rating. It brings you the cream of what the author has learned in training hundreds of pilots in his twenty years of continuous experience in both the Army and Navy Air Services and as a flying instructor and director of flight training in leading commercial flying schools. It is designed for use as a text in primary and advanced courses given at flying schools. It is also designed as a practical guide for pilots who wish to correct faults and attain greater proficiency in precision flying.

AIR PILOTING supplies a detailed system of instruction from first solo to blind flying. All flight test maneuvers now required for the various pilot certificates and flying ratings are completely analyzed and explained, with complete diagrams of maneuvers to illustrate every detail of their execution and make them clear and easily understood. Radio range layout, methods of orientation, private flyer's use of radio, are all thoroughly covered.

In addition to full instructions on primary essentials, the manual contains much information on advanced flying techniques, including exhibition aerobatics. Its descriptions of average faults and explanations of their causes will help you increase your own skill.

PARTICULARLY important are lists of specimen questions — totaling 377 — taken from official examinations for all grades of pilot certificates, including air line flying instructor. Answers that have been accepted as correct accompany each question.

OUTLINE OF CONTENTS

General Considerations. Advice to beginners. Pilot ratings and official requirements. Safety precautions. Ten Commandments of safe flying.

Airplane and Controls. Parts of airplane described; functions described. Wings. Fuselage. Engine and propeller. Control surfaces. Control parts. Landing gear. Pilot's equipment.

Primary Flight Training. Outline of procedure followed by typical schools. Detailed description of first eleven lessons with explanation of maneuvers taught.

Piloting an Airplane. Primary flight training maneuvers: Straight and level flying. Climb and glide. Gentle turns. Turns in glide. Climbing turns. The take-off. Taxying. Landing. Medium banks. Steep banks. Turns made in banks. Stalls. Spins. Base-line glide approach.

Civil Air Regulations. Selected air traffic rules which must be thoroughly mastered by student pilots preparing for government examinations.

Solo Pilot Flight Course. Procedure before and after solo. Factors to observe in primary S's 1 and 2. Advantages of the base-line glide approach. Summary of flight test requirements.

Private Pilot Flight Course. Shallow, circular, steep eights. Triangulation spirals. The 180°, 360°, 1080° spirals; vital factors to keep in mind. Practicing stalls, with and without power. Primary and advanced spins. Procedure for the 720° vertical bank. Crosswind take-offs and landings. Forward and slideslips; slipping turn.

Limited-Commercial Pilot Course. Requirement for higher degree of proficiency in same maneuvers as those in private pilot's flight test. Restrictions and privileges of the limited-commercial pilot rating.

Commercial Pilot Flight Course. Summary of maneuvers in flight test. Possible additions made by inspectors to usual flight test routine. Precision maneuvers recommended for developing highest skill in handling plane near ground, from predetermined exact altitudes. Night flying. How to execute the split-S turn; the chandelle; skyline S; half roll; barrel roll; loops; falling leaf.

Cross-Country Flying. Map reading. How to lay out a cross-country course. Facilities provided by Federal airways system. Preparation for cross-country flying. A typical cross-country flight with detailed explanation of pilot's procedure.

Airways Radio. Radio-range orientation described and illustrated—90° method, parallel bisector method. Radio compass navigation; fundamental principles explained. How to obtain bearings. Establishing fixes. Magnetic compass deviation. How to prepare a calibration chart of radio compass deviations. "Homing." Combined radio-range and radio-compass navigation. Charts.

Instrument Flying and Rating. Maneuvers that must be performed solely by instrument, in practical flight test. How radio skill must be demonstrated. Airplane. Link Trainer instruction methods. Flight Plan. Typical practice flight procedure.

Flying Instructor Rating. Requirements for special competency rating. Latitude given examining inspector to assure himself of candidate's qualifications. Summary of flying school rules and sequence of training maneuvers for primary and advanced students with which prospective instructor is expected to be thoroughly familiar.

Meteorology. Condensed selection of definitions and explanations pertaining to meteorology within scope of examinations given for all ratings above solo pilot.

Miscellaneous. Handling plane having 3-wheel landing gear. Exhibition aerobatics at low altitude: Inverted figure 8. Cuban 8's. Nos. 1, 2, 3.

THE RONALD PRESS COMPANY, Publishers
15 East 26th Street — ESTABLISHED 1900 — New York, N. Y.

COMPLETELY REVISED EDITION:

Engineering Aerodynamics

by Walter S. Diehl, *Lieut. Comdr., U. S. Navy; Engrg. Division, Bureau of Aeronautics. 2nd Edition.* 556 pages, 266 illustrations, $7.00

This handbook for airplane designers brings together a wealth of new material, digested and arranged in a form convenient for reference and application. It is a carefully planned, original development of practical design methods based on theory and experiment. Many involved theoretical analyses are reduced to simple working diagrams from which desired factors can be obtained directly. Tabular data and numerical examples are given where required. 440 equations important to the designer are supplied and their practical application explained. Of special interest are these outstanding features: new data and methods on applied wing theory, on control surface design, and on performance calculation and estimation.

SIMPLE, PRACTICAL METHODS:

Aircraft Propeller Handbook

by Karl H. Falk, *Chief Blade Designer, Hamilton Standard Propellers Division, United Aircraft Corporation.* 62 illustrations, $4.00.

Up to this time, information on propellers has been so highly theoretical as to be of little use in actual day-by-day work. Now this new book supplies a very practical method, simplified to the utmost. Eight chapters contain simple questions and "worked out" examples; they cover: Propeller Design. Aerodynamic Characteristics. Vibration. Static, Gyroscopic Characteristics. Twisting Moments. Strength of Propellers. Selection of Propeller.

A COMPLETE ENGINE COURSE:

Aircraft Engine Mechanics Manual

by C. J. Moors, *Chief Instructor, Department of Mechanics, Air Corps Technical School, U. S. Army.* 511 pages, 189 illustrations, $4.50.

Covers same ground as course given enlisted mechanics of Army Air Corps, with addition of much data on equipment used only on commercial planes. Deals thoroughly with all kinds of aircraft engines and their accessories. Mr. Moors gives all needed data on construction and operation, supplies full instructions for proper maintenance, and shows you exactly how to go about making repairs and adjustments.

Fill in, tear out, and mail

Sent on 5 Days' Approval

The Ronald Press Company
Dept. M249, 15 E. 26th St., New York

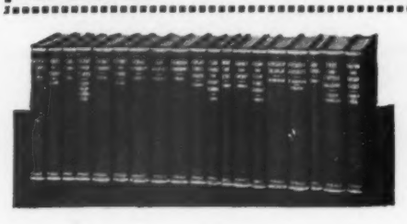
Send me the books checked below. Within five days after their receipt I will either return them or send payment in full at the prices shown, plus a few cents for delivery. (We pay delivery charges when cash accompanies order—same return privilege.)

- ☐ Simmons, Air Piloting..... $3.00
- ☐ Diehl, Engineering Aerodynamics..... 7.00
- ☐ Falk, Aircraft Propeller Handbook..... 4.00
- ☐ Moors, Engine Mechanics Manual..... 4.50

Name .....
Home Address .....
City ..... State .....
☐ Employed by,
☐ or Reference .....
Address .....

* Outside continental U. S. and Canada, cash plus 25c per book for shipping.

☐ Check here if you wish our catalog of Aeronautic Publications, FREE. M-249



The Birdmen's Perch

TEN'SHUN! The 5th edition of the Gulf Aviation Atlas has just come off the press and is *yours for the asking*. A big new stream liner carrying a pay load of flying dope, charts, maps, pictures, air history, etc. Everybody ought to have one. For your *free* copy, write:

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips,"
Mgr. Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

AVIATION QUIZ

Here's the first monthly quiz. Send your answers (and a big red apple) to old Professor Wing-Tips to be corrected. By the way, slip us your comments on the side with a question or two of your own—we'll give you a credit line.

1. Who was the first woman to fly the English Channel?

2. What is meant "by thumbing the sun?"

3. What was the date of the first round-the-world flight?

4. Give—within 5000 mi.—the number of miles of regularly established passenger airlines, foreign and domestic, operated by U. S. airlines at the end of 1937.

5. Has one plane ever made two trips around the world?

(The last edition of the Gulf Aviation Atlas broke all records for popularity! This one's even better. Send for yours today.)

DIVIDEND NOTICE

When you buy Gulfpride—the world's finest oil for planes—you're getting up to 20% *extra* lubricating power per quart.

For Gulfpride is refined both by conventional methods AND by the famous Gulf-owned Alchlor process that removes as much as 20% *more* sludge and dirt from the 100% Pure Pennsylvania.

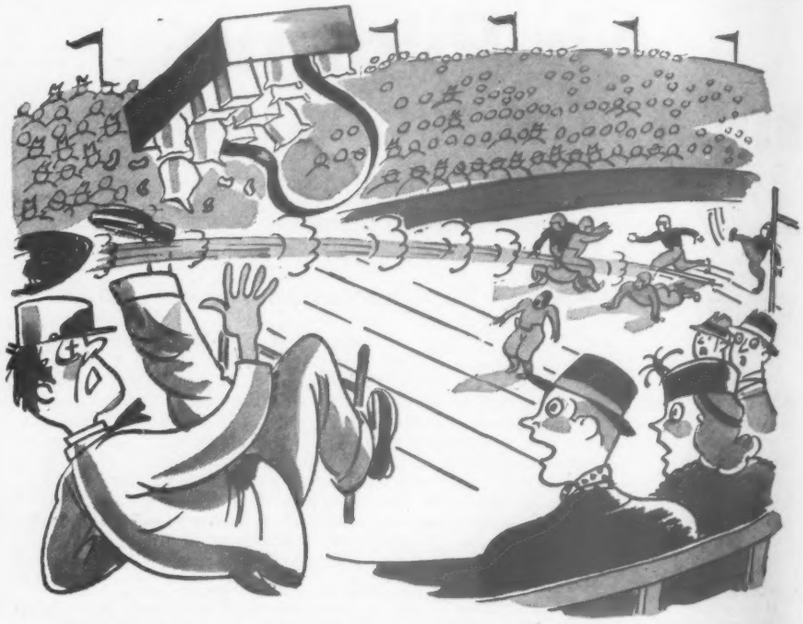
(Ques. *What valuable aviation handbook is available to all interested in flying, on request?* Ans. The new 1938 Gulf Aviation Atlas—a postcard brings yours.)

GOING WITH THE WIND DEPT.

The problem this month is a honey. If you get it, you're smarter than the two guys we tried it on. Mail your answer to T.W.T. for the official solution. All set...?

On a round trip between two cities a plane flew at a rate of 165 m.p.h. with the wind and 120 m.p.h. against it. It took 1 hour 48 minutes longer to go against the wind. How long was the round trip?

(P. S. While you're about it, ask for your Atlas. That's a honey, too!)



THIS MONTH'S WHOPPER

Dear Major:

When we can find a lawyer hungry enough to take the case we're gonna sue, but in the meantime I wanna tell you how you robbed us of our first Conference Championship since 1921:

Man and boy, I've been Captain and quarterback at East Swampscott Mechanics & Teachers for 20 years, but this year was the toughest ever. What with all the taxes comin' out of our sal—scholarships, it's been kinda hard to attract the right sort of young men to East Swampscott. So this season the team wasn't so hot.

Well, somehow we got through to our big game with Southwest Plumbers & Clamdiggers. It was a tough fight, but we were ahead 89-87. Their ball on their own 2-yard line, with 20 seconds to play. We figured we were in.

They came out of their huddle. The teams lined up. The ball was snapped. Then Steve Guzzy, their fullback, took it and booted a beautiful drop kick square between the goal posts 117 yards away! The fans went wild!

Later I found out what happened. Their Captain, the dirty crook, had a bottle of Gulf Aviation Gas in his back pocket, and when they were in the huddle he sprinkled some on the ball and some on Steve's right foot.

I forgot to tell you, after the ball cleared the goal posts it kept right on going. Knocked a peanut vender off the top tier of seats (he's suing you, too), clipped 10 feet off the gymnasium chimney (you'll have to pay the damages), and when last seen was headed straight for the Rocky Mountains.

Southwest thought they were pretty smart, but Steve ain't so happy about it. They have to keep a 100-lb. weight chained to his leg. The effect of that Gulf Aviation Gas ain't worn off yet.

Garrit Lydecker

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF **GULF AVIATION PRODUCTS**

THE AVIATION NEWS

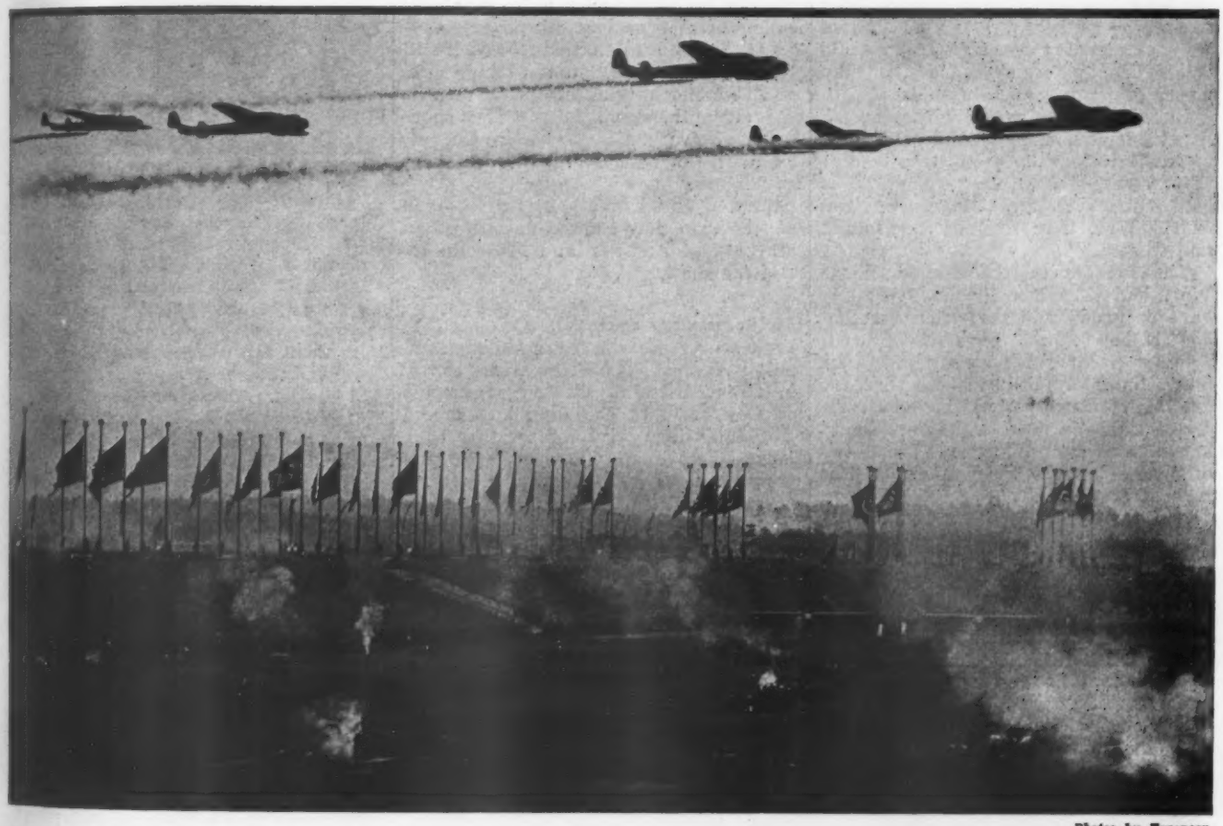
REVIEW, COMMENT, FORECAST

DANIEL SAYRE
C. F. McReynolds, *Pacific Coast*
Blaine Stubblefield, *Washington*
E. R. Lockin, *New York*

NOVEMBER 1938

Safety Scores Gains On Wide Front

(Story on page 55)



Photos by European

HITLER HAS A PARTY: An aerial interlude in the Nazis' three-ringed meeting at Nuremberg, which—with speeches—almost started the Second World War. Score the outcome of the crisis as you will, it was the air arm of Hitler's war machine which did the pounding on the conference tables.

NEVILLE TAKES A RIDE: In fact before Peace broke out, he'd made three round trips to Germany—all of them in nice shiny Lockheed transports belonging to British Airways. Nothing could have better emphasized the fact that—whatever Germany's strength—England was not yet far enough along with its air program to face a showdown.

SPOT LANDINGS ON THE MONTH'S NEWS

Crisis in Europe Reveals Air Power in Drivers Seat

For better or for worse, it would seem that "Aerial Age" all aviators have been expecting for so long is finally upon us. Between two printings of this department the whole continent of Europe moved to the brink of war, hesitated, then decided peace worth any price. And the whole business was as aeronautical as a high-speed wind tunnel.

The debits of the crisis were aeronautical. Peace would never have been threatened unless the Axial Powers were confident their air power could offset England's navy and the man power of France and Russia.

But the credits were likewise aerial. Air transport made possible the face-to-face meetings between state leaders that averted the final plunge. For lack of just such interchanges, the First World War, they tell us, was fought and wasted.

The horrors of the Second World War, had they come, would certainly have dropped from the skies. Whether gas bombs would have been used; whether great cities would have been indiscriminately bombed; whether the capitols of Europe would have been reduced to shells of wreckage—we don't know. But the nations of Europe—all of them—thought they would be and reacted accordingly.

Even the silliness that followed the outbreak of Peace had wings. October 10th, eleven of the "most famous" Soviet aviators came out with their Explanation-Of-It-All: Col. Lindbergh, after an "uninvited" visit to Russia this summer, had returned to London and reported to the "Pro-Nazi" set surrounding the Prime Minister that Russia's air force would be so ineffectual and disorganized as to be of little help in any action against the Axial Powers. This information, so ran the Explanation-Of-It-All, so discouraged Chamberlain that he capitulated abjectly to Hitler's demands.

Now even if it is true that Lindbergh made any such statement—and there have been plenty of denials—the idea that the leaders of England and France had no other data on Russian aviation or on the air fleets of Germany and Italy is one of the most naive that ever came out of a propaganda machine.

Maybe the Explanation-Of-It-All will go down in Russia, but if Chamberlain and Daladier haven't known for months the strength, down to the last squadron, of every air service in Europe, we are going to stop reading all those spy stories now flooding the newspapers. Whatever their figures—you can be sure they showed enough of an air bulge for Hitler and Mussolini to run the show.

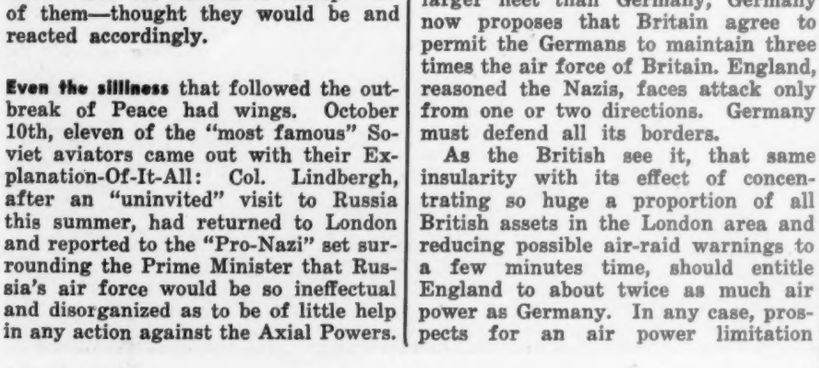
Air fleets wont decrease. October 13th the German press began a violent campaign against "excessive armaments" in Great Britain. Basing arguments on the fact that Germany has agreed England's insularity entitles her to a larger fleet than Germany, Germany now proposes that Britain agree to permit the Germans to maintain three times the air force of Britain. England, reasoned the Nazis, faces attack only from one or two directions. Germany must defend all its borders.

As the British see it, that same insularity with its effect of concentrating so huge a proportion of all British assets in the London area and reducing possible air-raid warnings to a few minutes time, should entitle England to about twice as much air power as Germany. In any case, prospects for an air power limitation agreement in Europe seem remote. Reports from England and France certainly indicate they won't fail for trying to be far better prepared in the air for the next crisis than they were last month. If there is a next crisis.

LOOKS AHEAD: Igor Sikorsky, speaking last month before Germany's Lilienthal Society for Aviation Research, had much to say on probable trends in transoceanic transport. After summarizing weights, drags, safety features of various types which might be tried in such service, he pointed to big flying boats as the logical solution. "Luxurious 100-ton airliners powered at 12,000 hp. . . . 50 staterooms . . . a cruising speed between 185 and 250 m.p.h. . . . is an engineering possibility in the immediate future." D. W. Tomlinson of TWA and Col. Lindbergh were other American delegates.

Washington, too, seems to have decided that the time has come when the U.S. must bring its air defenses into line with modern concepts of air power. For the past week news has poured out of the capital that Army and Navy appropriations will skyrocket next Congress to new peacetime levels; that the Navy air arm will be speeded toward the 3,000 planes already authorized; that the Army's authorized limit be boosted from 2,320 to 4,000; that substantial "educational orders" will be placed with potential wartime aircraft builders not now within the aviation industry; that within the industry itself every effort will be made to establish real "production basis" production. But so much for war.

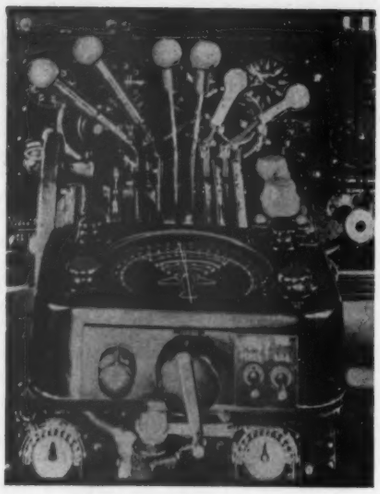
Like a cockeyed picture puzzle of which a goodly number of pieces are hidden in somebody's pocket, the trans-Atlantic airline situation of a few weeks ago seemed almost unsolvable. Then the alert financial correspondents of Wash-



HALF TRYING: With two engines off (and two props full-feathered) the Douglas DC-4 climbs cheerfully to 12,000 ft. with full load. Five months' tests show a 3-engined ceiling of 20,000 ft; a 4-engined ceiling of 25,000; a top speed over 240; a take-off with 60,000 lb. load in 850 ft.

ington who pick up many a fine tid-bit from the data filed by the Securities Exchange Commission came up with enough of the missing pieces almost to fill out the portrait. Specifically: American Export Lines had filed a registration statement for an issue of stock intended to raise approximately $1,000,000. Mentioned in the statement was the company's order for a Consolidated flying boat. Also mentioned was an agreement signed September 22nd with the Pan American Airways Company. By its terms, which are to run for fifteen years, Pan American will not only let American Export use the Azores (on which Pan American secured an exclusive American franchise), but also agrees to recognize American Export's exclusive privileges in developing routes to the Mediterranean and the northwestern coast of Africa. In return, American Export agrees to leave Pan American in exclusive possession of the northern route to England and Scandinavia. In the zone between, France and Germany, the two companies were to have equal development privileges.

In one fell swoop such an agreement removes the stigma of "monopoly" from Pan American's Atlantic set-up; creates a framework within which Germany, France and Italy can hope to secure operating privileges to the United States within a year or two; and promises to spur Imperial Airways in the preparations it must complete before it and Pan American can get under way with their long-awaited flight-for-flight arrangement.



NO BOTHER: The Sperry-R.C.A. automatic DF just sits there and points to the station you've tuned it to.

Labs Lick Five Tough Problems

New automatons measure prop shake, ground-height, position bearing, eliminate static, warn of stall

JUST WHY new technical triumphs in the cause of aviation safety should travel through space-time in flocks like Cubs headed for the Miami air races, we couldn't say. But last month within the space of just two weeks the research workers of this country unveiled no less than five new devices, each promising to overcome a major hazard in the path of aeronautical progress toward absolute safety. It became positively embarrassing to admit publicly that up until that time there had been so many hazards left in that path.

Two of these devices, based on super-ingenious use of radio phenomena, are described as to technical details in Don Fink's Radio Department on page 48 The first of them (by date of unveiling) was the Terrain Clearance Indicator developed jointly by United Air Lines, Bell Telephone Laboratories and Western Electric. We got our look at it October 8 at the Newark airport. To a half dozen of us sitting in the little white-tailed Boeing transport United Air Lines uses for a flying laboratory, the thing seemed almost incredible. Pilot Bill Little had swung us out over the Hudson soon after the take-off. As the plane flew along above the water, the pointers of both the TC Indicator and the sensitive Kollsman mounted next to it, of course read equal heights. But as we crossed the George Washington Bridge (whose roadways are 250 ft. above the water), believe it or not, the TC Indicator flicked downward exactly two hundred and fifty feet. Then as we swung westward across the high bluff of the Palisades it dropped four hundred feet, thus showing our exact height—not above sea level but above the ground immediately beneath us. Peter Sandretto, Superintendent of U.A.L.'s Communications Laboratory, says that after some further service tests, Western Electric will start work on enough indicators to equip all U.A.L. transports. After that the device will of course be available to everyone.

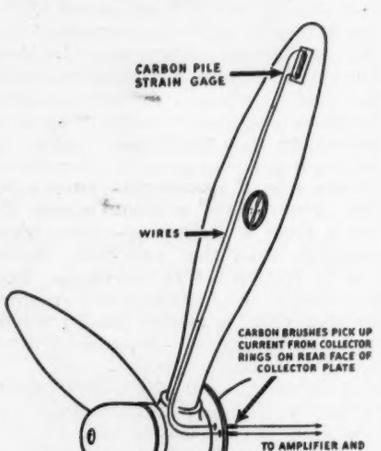
The other radio-using device, the Sperry-RCA Automatic Direction Finder was demonstrated just three days later from Floyd Bennett Field. This time an American Airlines flagship was used, swinging out over Long Island with the assignment of locating a small broadcasting truck. As though running there on tracks, we picked it up within a few minutes where it hid between two hangars at the old Curtis Wright Field at Valley Stream. In pilot-user's terms the device is a homing compass similar in principle to several others but automatic in its operation. Instead of spending valuable time manipulating knobs and judging null-points with a set of earphones and fumbling around with protractors and rulers the pilot now can glance at the face of this new DF (mounted on top the gyro-pilot unit in a transport) and get continuous, instantaneous bearings on any broadcast station upon which the unit is tuned. Its uses are legion. Example: Flying on course along a radio range with the regular range receiver, if you tune your DF to a station at one side of the course, you can follow your exact position along the beam from a strip map—upon which bearings from that particular station can be plotted before the flight. Such knowledge of instantaneous position coupled with the terrain clearance indicator readings of absolute altitude opens a complete, new era.

Another of the potent new safety devices is also in the radio field. As everyone knows United Air Lines a year ago found radio static could be

WE COULDN'T BELIEVE—the new Terrain Clearance Indicator really gave readings of absolute altitude until Peter Sandretto (above) took us up and proved it.

decreased by dissipating the airplane's charge from fine wires trailing behind the wing. But how many wires? And how to get them to trail without spoiling their vital "fine point" terminal characteristics with some such device as a small wind cone? It sounds simple, but the final solution announced last month is said to have cost some $30,000 to work out. It consist of a spring cartridge some six inches long and two inches in diameter which is mounted at the trailing edge of the wing and contains a five-length of fine braided wire specially developed by the Roebling company. When static interference grows severe, the pilot or co-pilot sets off the cartridge, thus driving the wire out into an extended position and effectively eliminating some 95 per cent of the static.

A fourth triumph is the new technique for the investigation of propeller vibration demonstrated by the Hamilton Standard Division of United Aircraft on October 5. As mounted on a propeller under test, the equipment used is the height of ordered-complexity and supersensitive recording mechanism design. But the principle involved is simple. As shown in the accompanying sketch, small strips of carbon are cemented to various parts of


CARBON PILE STRAIN GAGE
WIRES
CARBON BRUSHES PICK UP CURRENT FROM COLLECTOR RINGS ON REAR FACE OF COLLECTOR PLATE
TO AMPLIFIER AND OSCILLOGRAPH
COLLECTOR PLATE (ROTATING WITH PROPELLER)

the blade yet kept insulated from it. Tiny wires carry an electric current out to and through each carbon element. As the part of the blade beneath each element varies in length under load, the resistance of the elements change. Consequently variations in the voltages through each element can be measured and will trace analysable patterns on the record of an oscillograph mounted either in test laboratory or airplane cabin. As demonstrated at Hartford, the oscillograph apparatus was actually nearly a quarter of a mile away from the test house where the propeller was being run. Obvious advantages: the new technique is a God-send to designers tussling with problems increasingly severe as propeller dimensions grow larger and larger.

The last device on our list is the anti-stall warning hook-up described in N.A.C.A. Technical Note No. 670 by F. L. Thompson of Langley Field. It is not only simple in principle, it is also simple in actual mechanical detail. Many modern wings give little warning that they are approaching the angle of stall. By fastening a sharp-pointed "false-nose" over such a wing, however, the stall cannot only be made sharper, it can be made to occur a few degrees sooner. The new N.A.C.A. device actually fits such a "false-nose" over a few inches of the span. A Pitot-static unit is mounted almost flush with the upper surface and a few inches in the wake of the "warning section." Now, as the plane approaches stalling, the warning section will first go past the burble point. The Pitot-static unit will pick up the disturbance of the flow past it. With a relay mechanism, the reaction can be made to light a light or sound a klaxon.

DAY BY DAY WITH THE C.A.A.

SEPTEMBER 23—Safety Board appoints small special staff to be built up for investigation of accidents and study of prevention. Present appointees are for Washington, coordination of field work, Wm. S. McDuffie, executive officer; Louis R. Inwood, assistant to McDuffie; Jesse W. Lankford, Chief, accident analysis; also Robert D. Hoyt, Phil C. Salzman; Wm. F. Centner; Walter S. Stapler; Roland Rohlfs; John Foscue. Same were transferred from the old Bureau of Air Commerce.

SEPTEMBER 23—Administrator Hester placed airplane at disposal of WPA afficials for New England flood survey and instructs all CAA personnel to cooperate; waives pilots' time restrictions to a degree; waives operating certificates so all airlines can aid in rushing relief.

SEPTEMBER 25—Administrator Hester dedicating Winchester, Va., airport, says CAA will save air transport from over-expansion evils that befell railroads and electric utilities.

SEPTEMBER 27—CAA announces plans for 750-acre Washington airport at Graverly Point one mile down Potomac from present Hoover field. It will be a joint PWA, WPA, Army and CAA project, ready for service in one year, complete at the end of 1940; 500 acres will be "made" land.
Chairman Noble announces $7,000,000 airway program, begun a year ago is nearing completion, and "airlines will have available for this winter's operations a greatly improved system with many recently developed aids." He catalogues what will be done by January 31, 1939.

SEPTEMBER 30—Chairman Noble writes federal officials, urging patronize airlines during air Travel Week October 1-9. (Note: President Roosevelt's order that G-personnel travel be held to minimum was still in force as this was written—ed.)

OCTOBER 1—Board members and Administrator Hester fly to New York to participate in aerial parade over the city as guests of Mayor LaGuardia, riding in the Bermuda Clipper of PAA.

OCTOBER 4—Administrator Hester, R. C. Gazley, chief of Safety & Planning, and Major A. B. McMullen meet with advisory committee of twenty, representing federal and other interests, plan national airport survey, to cover 800 fields. Report to Congress is due by February 1, 1939.

OCTOBER 6—Air Transport Association's Operations Committee are informed by CAA that number of radio direction finding stations will be installed as additional safety aid. Ralph Damon, Chairman of Committee, tells CAA about operators' cruising agreement. Agree operations subcommittee will meet with Earl Ward, Chief of CAA's Airways Operations Division, October 17, Chicago.

OCTOBER 6—Chairman Noble speaks on Columbia radio hookup sponsored by US Junior Board of Commerce, suggests federal aid and encouragement for private flying.

OCTOBER 7—CAA announces applications for convenience and necessity certificates have been filed by 18 existing airlines. Nineteen new routes mostly in Mississippi Valley would add 9,000 miles to present 32,000 miles.

OCTOBER 10—Chairman Noble, press relations man C. B. Allen, and other Authority personnel fly in the United-Western Electric radio altimeter plane. say its "marvelous"; registered when they flew over a dirigible.

OCTOBER 10—CAA receives Pan American application for adjudication of mail rates on San Francisco-Hong Kong run, first case before the authority. PAA asks $7 a mile westbound; $8 a pound on all China-Hawaii mail; $8 a pound on Hawaii-US mail; all foreign postage. Present rate is $2 per mile. Demand is based on average current losses of $95,000 per month.

OCTOBER 7—Administrator Hester makes a speech at National Air Mail Feeder Conference, Kansas City; tells meeting "Some of those new routes may be established. But only through proof of their validity as specified in the Civil Aeronautics Act of 1938."

AVIATION IN WASHINGTON

by BLAINE STUBBLEFIELD

The Capital Grows Very, Very Air-Minded

To the Chief. Despite all argument to the contrary, Washington knows that air forces are moving up to the front in defense operations. How far this advance will take the Air Corps in the coming years, or what emergencies may arise, no one can say. Great responsibility has been placed upon Maj. Gen. Henry Arnold. He may some day be called upon to help make momentous decisions for this country. General Arnold has lived all of the history of airplanes, yet at the same time he is a youthful man who looks only forward. He had administered his past offices with such wisdom, kindness, and strength that he now has a vast reserve of confidence down through the ranks to carry him on.

How airplanes changed the complexion of two first-line emergencies: New England flood-hurricane and the Czech crisis profoundly impressed men like Norman Davis, chairman of the Red Cross; and this time it hit the striped pants boys who move the controls of the United States and other countries—right between the eyes. How "Airplane" Brisbane could cut loose now, if he were above ground! When Chamberlain climbed aboard, and when CAA relaxed pilots' hours limit on the Boston run because no one else could do the job, the airplane arrived.

US aid for non-scheduled flying has moved from the back to the front of official minds here, and it will mean business if it jells. CAA Chairman Noble told the federal government in a nice way on a national radio hookup that it is sucking its thumb while England, France, Germany, Italy, Russia and other countries turn out tenderwings in droves. He referred to the Fiesler-Storch plane, and to the safe aircraft development work of the old Bureau of Air Commerce, which was done under the leadership of John Geisse. Outside of possible government interest, most observers believe the Authority's new private-flying investigation will yield nothing but old answers. But the Section will earn its wages if it can only clarify the status of what little activity there is—meaning do something about those regulations.

Pan American mail rate hearings should be well along as this writing goes to mail. This is CAA's first mail rate case. Vice Chairman Harllee Branch, with years of PO experience to draw on, is key man. Rate determination in this case is a very delicate operation. World status demands oversea air success more than ever; if PAA's statements on losses are accepted, they rightfully ask more revenue. But more subsidy, if such it is, to foreign service, will encourage the domestic demand, and CAA knows it. Incidentally, mail rate determination is a tedious job. Reports that it can be done in 30 days are entirely erroneous.

Washington runways are the scene of much confused taxiing up and down as the Authority hurries to get away on its airport survey, due on Capitol Hill Feb. 1. The airport section is commendibly determined to base its study on real data, to avoid pre-conclusions. It narrowly escaped a comedy of economists' errors, which caused some tittering around town, when it considered but finally balked at a proposal to determine in cold figures the financial relation of each airport to the nation, to the community, to the operators, etc. Critics said it better leave out the fancy equations, decide what's needed, how much it will cost, then talk turkey as to who will pay for it.

Model Airport at Washington may be something to copy when it's finished in 1940, but the dozen-year wrangle that preceded it is no shining example. President Roosevelt, probably one morning while brushing his teeth, reflected that Congress had see-sawed up to now and probably would do it again next session. So, without calling signals he threw a pass during time out, CAA nailed it, and headed right into the wind. Money will be taken from this and that fund to start the job, and then Congress will have to ante to finish it. This port will be 750 acres, mostly "made" land in the Potomac, one mile beyond Hoover Field, which is five minutes from town center. Wonder if the hangars will be Greek temple architecture.

CAA Work Sheet this month shows (1) airport survey causing much tail-flutter; (2) study of financial condition of lines most arduous; (3) effort to catapult private flying most hopeless; (4) airway aids improvement most gratifying; (5) study of foreign and oversea airline policy and relations all under the hood and inducing dizziness; (6) reorganization of old Bureau into CAA; (7) trying to write a CAA budget for next year; (8) trying to keep the "feeder system" away from the trough. These items are in no order.

CAA's Horizon is moonlight and roses but a ten-power glass would show a small cloud. Congress put a bigger load on the Authority than it will ever know. CAA must hire more and more help, expand, spend. Congress will object, inspired by other transportation, and will point back to what will seem like frugality of the old Bureau, ICC, and PO. It will try to starve the Authority down. If the industry chooses to do so, it can use the same power that ousted the conflicting agencies, to protect the Authority.

Third SAFETY man is still un-named as this is written, and even curbstone appointments are scarce. Opinion hath it, however, that the third member of the safety board should be a man experienced in overwater operations, which will increase greatly, and which have many problems unlike those of overland flying. This is no prediction.

Air Travel Week was more than met the eye. Operators had for years spent their energy, time and money in a dogfight over a handful of air travel converts, instead of making a concerted effort to sell the public on a big scale. Now the new law makes the industry a controlled monopoly with in-fighting no longer necessary or permitted. Air Travel Week was the first step by a united air transport front.

In Air Corps corridors you hear bold hints that the Baker Board's goal of 2,320 airplanes is now horse and buggy stuff. Air power is rumbling in *all* Capital corridors. Two high authorities told this writer in one day that Germany's air fleet was the argument that won the Czech show-down. (Aviation business is due for big things, but don't call up your broker; government control will prevent much profit to speculators.)

Old men aloft are okay by the War Department; nobody says fiftyish men can't fly perfectly well. But the authorities are inclined to think that commanding officers should let others have the controls while said commanders give full attention to their missions. They can't do their best doing both. Such an order, of course, would be given only after thorough staff study.

Fragments; European air lines in and to South America are putting something of a crimp in PAA business; they bring stuff direct that would otherwise go by New York or the Gulf. . . . Newcomers in CAA are having a time learning whether to say "aviation with first a long or short. . . . C. B. Allen has the only sideburns in Washington. . . . Vague story going around town that four big airports to be built in Nova Scotia will be available to US civil and military use.

STREAMLINED MILESTONE: Lon Wheeler, Solar Aircraft Vice-President, looks over the 5,000th stainless steel exhaust manifold turned out by his company.

LET'S TALK BUSINESS

Douglas Aircraft has dropped the name Northrop Division from its plant at Los Angeles airport and will designate it simply as the El Segundo Division of the Douglas Aircraft Company. Aircraft manufactured in the El Segundo plant will be known as Douglas aircraft. E. R. Doak is general manager of the El Segundo division and E. H. Heinemann, chief engineer.

Charles W. Deeds has resigned as vice-president and director of United Aircraft to become president of the recently formed Chandler-Evans Corp. of Detroit, manufacturers of aircraft carburetors, fuel pumps, and aircraft accessories. Other officers are M. E. Chandler, W. B. Groves, E. J. Hill, vice-presidents in charge of engineering, sales, and fuel pump department respectively; M. E. Stover, treasurer; Prewitt Semmes, secretary. The company, formerly Chandler-Groves Co., manufactures the Chandler-Groves carburetor now used on Wright Cyclones.

Taylor-Young Airplane will have new working capital available. A controlling block of the company's stock has been placed in a voting trust, of which F. L. Wehrhan of New York, C. A. Harrison of Fairchild Aviation, Inc., and J. S. Ogsbury of Fairchild Aviation Corporation have been made voting trustees. Richard H. Depew, Jr., Fairchild distributor for New England, New York, and New Jersey, has been made vice-president and general manager. He and C. A. Harrison of New York have been named to the Board of Directors.

Grumman Aircraft has received a contract from the U. S. Navy for 20 Model J3F3 amphibians, involving $754,000, bringing its backlog as of Oct. 1st to more than $4,400,000. The ship is similar to Model J2F2, 30 of which are now under construction for the Navy. Grumman has also sold four Model G 21-A amphibians to the Peruvian Air Force.

Sperry Gyroscope's sales division has added F. W. Castle, West Point '30, and formerly a pilot with the First Pursuit Group at Selfridge Field. Since 1934 he has been associated with Allied Chemical & Dye Corp. His father, Col. B. F. Castle, headed the Air Service Control Board during the World War.

Stearman Aircraft has completed delivery of its latest Philippine contract, comprising six Model 76D3 advance trainers and three Model 73L3 primary trainers. The 76D3 is powered with Pratt & Whitney Wasp Jr. SB, and the 73L3 with Lycoming R680-C1. The Philippine Army Air Corps uses Stearman equipment exclusively for primary and advanced training.

Solar Aircraft of San Diego has opened an eastern sales office at 60 West 42nd St., New York City, placing in charge as eastern sales representative W. K. Wheeler. He has been connected with the company since 1931, as welding foreman and latterly as factory superintendent.

R. G. Perry has been elected vice-president and director of Aircraft Industries of Montreal. The company has full Canadian rights for manufacture and sale of Wright engines and is builder of Beechcraft, the North American Trainer as well as the new Noorduyn freighter.

SAE nominees for vice-presidents for 1939 include William Littlewood, vice-president, engineering, American Airlines, and H. K. Cummings, chief, Automotive Power Plants Section, National Bureau of Standards.

Glenn L. Martin completed the 300th Martin Bomber of the twin engine type series on Sept. 21. The company is now occupying a new building at its Middle River plant, to be used exclusively for its drop hammer department. The structure has a 10,000 sq. ft. floor space, and with its new equipment represents a $75,000 investment.

Brewster Aircrafts Parts division of Brewster Aeronautical Corp. has received a domestic order for wings and tail surfaces totalling $175,000, bringing total unfilled orders of both divisions up to $2,187,643.

Fairchild Aircraft Corp. has completed deals for fourteen Model 24s to be delivered to Australia, Siam, Alaska, France, South Africa, Puerto Rico and Japan, and reports that several more important deals are in process of negotiation.

Douglas Aircraft has made W. G. Jerrems III personnel director. Connected with the company since 1925, Jerrems has served as supervisor of metal fittings, assistant superintendent, night superintendent, and day superintendent.

Irving H. Taylor, heretofore Acting Chief of the Automotive-Aeronautic Division, Bureau of Foreign & Domestic Commerce, has been appointed its Chief. Through long association he is widely known in U. S. and foreign automotive and aeronautic circles.

Bendix Airport, Inc., recently incorporated at Trenton, is proceding with the development of Bendix Field, Bendix, N. J. (formerly Teterboro Airport), to make it one of the centers for research and private flying in the east. Officers of the new corporation are Vincent Bendix, president, Harry A. Bruno vice-president, Louis F. Mitten, treasurer, Harold Hofmann, secretary.

Los Angeles' Chamber of Commerce, checking on L. A. County aeronautical activities, claims that 25 per cent by number, and 50 per cent by dollar volume, of all aircraft manufactured in the U. S. during the first six months of 1938 were built in or near Hollywood. Aircraft exports from L. A. harbor lead all other exported products—over $1,000,000 in August and again in September. Backlogs of unfilled aeronautical orders for all L. A. County topped $66,000,000 as of Oct. 1st.

North American Aviation's backlog is close to $18,000,000. Production performance for August of 60 planes built and delivered is being maintained through new equipment and more than 3500 men working two shifts a day. The first of its basic trainer-combats for England has been completed and following tests, the 200-plane order will be shipped to Great Britain for assembly. It has also completed for the export market a new fighter-bomber of advanced type (reported speed in excess of 250 m.p.h. More than 1000 planes of the same basic type have been built or are on order for domestic and foreign use.

Lockheed's order from the British Air Ministry for spare parts amounting to $3,900,000 complements its previous

order for 200 reconnaissance bombers, bringing the company's backlog up to about $24,000,000. Delivery of $5,111,699 in planes and parts for the first six months of 1938 compares with $2,644,991 for the same period in 1937. Production average of one plane each working day is anticipated. Changes in administration include C. A. Barker, Jr., vice-president in charge of finance; Cyril Chappellet, assistant to the president; S. W. Voorhes, assistant sales manager, R. A. Von Hake, works manager.

Ryan Aeronautical Company's backlog as of Oct. 1st was $300,000 and included substantial contracts for exhaust manifolds and other parts for Consolidated, Lockheed, and others.

Precision Bearings of Los Angeles, subsidiary of Norma-Hoffman Bearings of Stamford, Conn., has appointed Harold R. Swanton sales manager for all divisions, including aircraft, on the Pacific Coast.

PROFITS AND LOSSES

» GRUMMAN AIRCRAFT ENGINEERING CORPORATION has declared a dividend of 25c. per share on its common stock. Since the initial disbursement of 25c. in December, another dividend in like amount was paid on June 27, 1938.

» NORTH AMERICAN AVIATION, INC., has voted a dividend of 40c. a share, payable Dec. 1 to holders of capital stock on record Nov. 15th. Initial disbursement of 12½c. a share was made in December, 1937. J. H. Kindelberger, president, reported that "unfilled orders Sept. 30 amounted to $14,800,000, despite record deliveries of approximately $6,000,000 in the first nine months of 1938."

» RYAN AERONAUTICAL CO. and its wholly owned subsidiary, Ryan School of Aeronautics, net profit for the eight-month period ending Aug. 31, 1938, $31,451, after all charges. Net profit for the entire year of 1937 was $18,995, compared with $4,223 for the year 1936.

» THOMPSON PRODUCTS, INC., for the six months ending June 30, 1938, net profit of $112,097, despite a net loss for the first quarter.

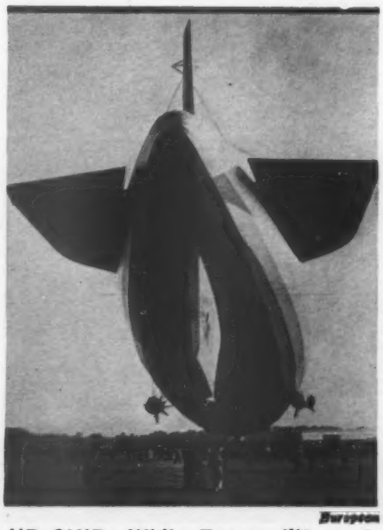
» SOLAR AIRCRAFT CO., net profit for first 20 weeks of current fiscal year, ending Sept. 17, 1938, $31,577, equal to 23.8c. per share on 132,650 shares of common capital stock, which is 123% increase over same period last fiscal year. The company announced a dividend of $1 on common stock of record Oct. 1, payable Oct. 10. Net sales for the period were $281,048, a 95% increase over same period in 1937.

AS OTHERS FLY IT

A Birdseye-View of Aviation Abroad

Flying Dutchmen Hang Up Traffic Marks

Dutch delight over K. L. M. traffic this year is backed up by figures for the first eight months. Passengers on internal lines hit 27,670, just about double last year's results, and express went from around 100 to 150 tons. More and better local services, plus low fares, must be pulling pretty well, because at this rate one in every 200 Dutchmen will buy a ticket this year. That's nice going for a country 200 miles long by 100 across. . . . On European runs passengers are up 15% to 74,234; a hundred tons of express and fifty of mail went along with them, both increasing around 50%. . . . Douglas DC-3s and a schedule boost from twice to three times a week helped the Amsterdam-Batavia line to a new high—3,460 passengers against 2,423 last year. Express business went up 74% to 46 tons. Since June 1 the line has been hauling all first-class mail between Holland and the Dutch East Indies, which did a lot to put the total up to 113 tons, an increase of 33%. . . . K. L. M. lines in the West Indies carried 4,136 passengers (42% increase), 16 tons of express (77%), and three tons of mail (118% up). The 1400 route miles of this section will take another jump before long with an extension into the British West Indies. The British gov't has given them a concession to run between Barbados and Trinidad, which bears out the stories that the British aren't much worried about starting their own lines over there as long as there are still some main links in the Empire routes to be filled. . . . K. L. M. is thinking 4 engined equipment for delivery a couple of years from now—Chief Pilot Parmentier has gone to the U. S. to look over the crop there. . . . Flying around 22,500 airplane miles a day over 12,000 miles of routes takes a lot of somebody's money, and K. L. M. has been after a subsidy increase to go with the extensions of service and the Number One equipment they've laid out for in the last year. What with the arms race hitting Holland too, they've been turned down, but since their proportion of subsidy to operating income runs very low for a World Airline (under 10%).



Europa

UP SHIP: While Europe jitters at the threat of War, the Zeppelin Company tests the new "Graf Zeppelin" for the tasks of Peace. Inflation—thanks to us—was by hydrogen.

Ten million ton-miles of airmail a year is the present pace of Imperial Airways under the Empire scheme. Outbound loads from England are running around twenty tons a week; inbound about ten tons. This is batting up near the 24 tons per week outbound Imperial agreed to carry for £900,000 mail pay and £600,000 subsidy—over it the Post Office has to pay extra. Figuring only what the British get for their money on mail sent from England (the rest of the Empire helps out with payments for return trips), this works out at around $1.20 per ton mile with today's loads, split about 70 cents from mail pay and 50 cents from subsidy. . . . With the All-First-Class-Mail-by-Air system now working between most European countries, about 1,950 tons a year of British first-class foreign mail gets airmail service without extra postage. About 1,100 go to the Empire and 850 to the Continent. The Post Office figures that about 800 tons of first class mail go to North America, which should furnish a lot of customers for the Atlantic route . . . New Zealand will come into the Empire network early next year—a joint company has been formed by Imperial, Quantas Empire Airways (they handle the Australian section of the present line), and Union Airways of New Zealand to run across from Sydney with some Short super-Empire boats. Since July New Zealand-Britain mails have been carried to Sydney by ship and on from there by air, all for three cents a half ounce—a great gripe to Australians who are still pyaing ten cents a half ounce for domestic and foreign airmail . . . Australian internal lines have had their routes and subsidies juggled again, with Quantas and

Australian National Airways coming out on top with the biggest share. Total subsidies will run £200,000 a year—unsubsidized lines will get around $2.00 per pound of mail carried. Come next year the lines will carry all first class mail, and meanwhile the subsidized lines will distribute incoming Empire mail without extra postage.

Gadgets of the month are led by the arrangement of the pusher Jumo diesels on the Dornier Do. 26 boat. The engines are well forward on the wing, driving the props through long shafts. The whole rig can be cocked up ten degrees for landing and takeoff, raising the props above the trailing edge clear of spray . . . The Germans have another idea—a power unit interchanging among different types of planes. Lufthansa has too many different kinds of routes to standardize on one model of ship, but they figured if they could get a power unit that could be swapped around anywhere they'd lick a lot of maintenance problems. Junkers has worked up an installation used on three types so far—it has a B. M. W. Hornet and the Germans claim four men can make the switch in a half hour. The four points at which the unit fastens to a standardized bulkhead in the ship and all connections for controls, piping, wiring, etc. are kept out toward the outside where a man can get at them without standing on his head. The oil tank is part of the unit, and the cowling is worked out so that most of it stays around the engine and comes off with it. . . . A new kind of tricycle gear has been tried out on a light plane in England. The two rear wheels are steerable, while the nose wheel castors with an over-riding control from the rudder pedals. It's designed for cross-wind landings—the pilot sets his rear wheels before landing so they're pointing along his ground path, and comes on in crabbing with the axis of the ship at an angle to its path. It isn't meant as a contribution to foolproofness—its inventor hopes it will help solve the airport problem by cutting fields down to one-direction strips.

LOGGING THE LINES

Air Transport Drift Sights

by DAN SAYRE

Rate Plea Gives C.A.A. Devil-Deep Sea Choice

P.A.A. put the C.A.A. on the spot last month by applying for a complete revision of its air mail pay scale in the Pacific. Despite "best efforts to reduce expenses," the company's books showed a loss of $475,000 for 1937; $374,000 for the first half of this year; and current losses of about $95,000 a month due to the operation of only a 60 per cent service since the loss of the Hawaii Clipper. All this on a mail contract with a base rate of $2 per mile in both directions between San Francisco and Macoa. "Fair and reasonable" rates the company thinks would be: $7 per mile for the westward flight for a maximum of 800 lb. plus $1 per thousand pound miles above that poundage. On eastward U. S. mail the company would like $8 a pound from Guam to Honolulu; $8 a pound from Honolulu to San Francisco; and all the income from foreign mail credited to the operation by the Post Office.

Now the dilemma is this: If Pan American is turned down on its request and carries through its implication (that unless its scale is forthcoming, it will have to suspend service) then Hawaii, the Philippines, and a good slice of American business will howl over losing air mail facilities. The State Department will decry loss to American prestige in the Orient. The Navy will be saddened over the prospect of losing Wake and Midway as potential patrol plane bases. But if the C.A.A. should grant what P.A.A. asks, the Post Office will swoon at the cost; Congress will storm at the new "subsidizing"—and perhaps most clamorous of all—the domestic operators will pour into Washington with air mail petitions kited higher than a balloon barrage. After the C.A.A.-A.T.A. release last month cautioning operators not to expect the C.A.A. to "play Santa Claus" that certainly would be embarrassing.

AIR TRANSPORT INDICATOR

October 1, 1938

104.9

Which is the ratio of the revenue passenger miles reported by the Air Transport Association as carried by all domestic airlines during September 1938, to the corresponding figure for September, 1937.

For the first time in 1938, traffic, at 49,480,616 pass-mi., was new all-time high. First nine months totals: 1937 — 310,744,749; 1938 — 345,906,887, up 11.3 per cent.

Fairchild

IT WONT BE LONG NOW—before it will never seem short again. A recent aerial photo shows the Chicago Municipal Airport's astounding progress toward becoming a truly first class airport. Not long ago the upper righthand quadrant was all the field there was.

The C.A.A. airport survey holds promise of many developments helpful to the general air transport picture. But no matter what the survey's findings turn out to be, the new Authority has already earned a fine big feather for its cap by solving Washington's terrible terminal problem. The C.A.A. had hardly assumed office when—with full Presidential backing—it began a realistic survey of the situation. After considering all available sites it came out flat-footed for the long-proposed plan of a made-land project at Gravelly Point, just a mile down the Potomac from the present Hoover Airport. That will leave Washington's terminal within four miles of the White House and Capitol, provide approaches infinitely less obstructed than at present, and a

site which can be built up to some 750 acres of area. Four five-thousand foot runways are to make the field itself "a model for the nation." Work under a committee formed by WPA, PWA, Army engineers and CAA is to start immediately. The field is to be opened for use in about a year with extensive buildings and finishing touches taking another twelve months to bring to the peak of perfection.

The air lines won New England gratitude forever late in September when for a period of about ten days the air line between Newark and Boston was the only or the most effective method of communication in actual operation. Normal traffic for the period between September 22 and October 1st would have been about 800 passengers. When the hurricane cut railroads and highways no less than 9,000 passengers climbed aboard American Airlines' flagships or took passage on TWA and UAL transports, diverted during the first days of crisis from their normal routes. In addition, the route handled 272,381 lbs. of first-class mail between New York and Boston and 27,000 lbs. between Boston and Albany, where rail communication was also cut.

Trans-Southern Airlines, Inc. is the name of a new project which will—if the C.A.A. approves its application for certificate—open an air line between Amarillo, Texas and Memphis, Tenn. via Oklahoma City. Other cities which would be calling points are Elk City and Muskogee, Okla., Fort Smith and Russelville, Ark. Officers: Jerry Sass is president and general manager.

Gross express revenue for August was the third highest for any month on record, according to Railway Express Agency. The increase in revenue for that month over the corresponding period in 1937 was 9.05 per cent. Shipments for the month numbered 58,308, an increase of 10.6 per cent.

Log Entries: New York's North Beach airport has signed its first bona fide tenant. American Airlines has agreed to occupy hangars 1, 3, and 5 for a ten-year term beginning May 1, 1939. For the first year rentals will be approximately $125,000. United, TWA, and Eastern are expected to sign leases in the near future . . . Eastern Air Lines, reporting an increase in passenger business in September of 9.9 per cent over 1937, announced the appointment of Thomas F. Armstrong as secretary-treasurer to succeed J. J. Mehl, resigned . . . Seventeen domestic airlines have announced that the maximum baggage allowance per passenger (without surcharge) has been increased from 35 lbs. to 40 . . . American Airlines which on Sept. 25th replaced the last of its Stinson As (on Cincinnati-Washington run) with Douglas DC2s, thereby becoming an all-Douglas airline, has announced an order for five more DC3s of the Sky Club type. . . .

AVIATION PEOPLE

Who's Who in This Month's News

TWA: Paul E. Richter, formerly Vice President in charge of operations for Transcontinental & Western Air has been named Executive Vice President in charge of operations, sales and accounting. Larry G. Fritz replaces him as V.P. for operations. Vincent P. Conroy becomes nation-wide Sales Manager. John B. Walker, formerly V.P. in charge of traffic, now V.P. at large.

UNITED: John A. Herlihy, for the past year Director of Engineering for United Air Lines has been appointed Vice President in charge of operations. Vice President R. W. Schroeder will devote his entire time to safety policies. R. E. Pfennig and S. V. Hall have been named Manager of Operations for the Eastern and Western Divisions, respectively.

BENDIX AIRPORT: Harry A Bruno has been named a Vice-President of the new company formed to develop Bendix, N. J. as an air center (see page 58). A founder of the Quiet Birdmen, Bruno is in the front rank of the country's aeronautical publicists. Few know that he started his flying career in 1909, served with the R.F.C., once held a big-time seaplane distance record.

INTERCONTINENT: William D. Pawley is the President and controlling stockholder of the Intercontinent Corporation, since the end of August completely independent from its former Sperry control. With ten years of background in promoting Sperry's international interests, Pawley has proven himself one of the leaders in the development of our aeronautical exports.

SCOUTING THE SQUADRONS

Notes and Comment on our Air Defenses

The A.C.'s $7,000,000 air depot at Sacramento, Cal., is rapidly nearing completion. Personnel and equipment is already being moved from North Island, San Diego, and the move is to be completed by Jan. 1, 1939. The Navy will then take over occupancy of the entire North Island plant. The area assigned to the Sacramento depot—one of four such within the U. S. —will include California, Oregon, Washington, and to some extent Hawaii and the Philippines.

Brigadier General Henry H. Arnold, appointed last month to be Chief of the air corps with the rank of Major General, is one of the few original "old timers" still serving in the Air Corps. Graduating from the Military Academy in 1907, he took flight training direct from the Wright brothers in 1911. In 1912 he won the Mackay trophy (the first time it was offered); in 1934 he won it again by leading a flight of ten Martin bombers from Washington to Alaska and return. In March 1935 he was named C.O. of the 1st Wing of the GHQ Air Force. In December of that year he became Assistant Chief of the Air Corps.

GEN. HENRY H. ARNOLD:
Owns two Mackay trophies

Other shifts of high AC command last month moved Colonel Walter G. Kilner from the post of Chief of Staff GHQ, Langley Field, to Washington to become Assistant Chief of Air Corps with rank of Brigadier General. Colonel Walter H. Frank has gone to the Hawaiian Islands to assume command of the 18th Wing assuming the rank of Brigadier General upon his arrival. Colonel Herbert A. Dargue moved to the Canal Zone to assume command of the 19th Wing and the rank of Brigadier General.

Fort Bragg's two weeks of exercises which ended October 16 had many an interesting angle: It was the first large-scale try-out of an actual "warning net" manned largely by civilian volunteers. Some experiments had been tried in the past with such a net in California. Last spring GHQ maneouvers over New England "assumed" that such a network was functioning but last month no less than three hundred and seven different stations turned in reports through fifteen different telephone companies. The network worked so well that in some cases the "hostile" aircraft were spotted two hundred miles away. October 13 fifty-eight North Carolina cities and towns were "blacked out" over an area of 15,000 square miles during an "invading" attack. That, too, was successful despite the fact that only one tiny blackout of a single Long Island town represented sole American precedent.

Major General Oscar Westover, killed Sept. 21 at Burbank, Calif., together with his pilot Sergeant Samuel Hynes, will be long mourned by the Air Corps. Entering the Army in 1901, Oscar Westover was appointed to the Military Academy the following year, graduated in 1906. Entering the air service after the war he became one of the few officers of the army ever to hold all four ratings as airplane pilot, airplane observer, airship pilot and balloon observer. January, 1932 he became Assistant Chief of the Air Corps, under Major General B. D. Foulois. After some months as acting Chief he received his appointment as Chief of Air Corps in December, 1936. During his tenure of that office the GHQ air force was organized and put through its all-important first periods of development. The training, morale, and general effectiveness of all personnel, was markedly advanced. Bases were improved all over the United States. Aircraft were procured of such rapidly advancing types that the Air Corps under General Westover's command at the time of his death was incomparably ahead of the force he took over but a few years earlier. No greater tribute could be paid than to say that a large measure of that Air Corps progress can be traced to the personal attributes of this man.

GEN. OSCAR W. WESTOVER:
Corps Progress, his monument

Flight Log of the PBYs (a)

	Date	From San Diego to:	Miles	Total Airplane Miles	Time	Number of Airplanes	Number of Men
	1-28-37	Pearl Harbor	2,553	30,636	21H 43M	12	80
	4-13-37	Pearl Harbor	2,553	30,636	21H 21M	12	80
	6-21-37	Coco Solo	3,087	37,044	27H 58M	12	84
(b)	6-24-37	New York	2,700	2,700	17H 3 M	1	6
(c)	8-..-37	Polar Area	19,000	19,000	.....	1	5
	9-..-37						
(b)	12- 3-37	Miami	2,300	2,300	14H 10M	1	8
	12- 8-37	Coco Solo	3,087	43,218	22H 20M	14	98
	1-19-38	Pearl Harbor	2,553	45,954	20H 30M	18	127
(b)	2-26-38	Miami	2,300	2,300	12H 35M	1	6
(b)	6- 3-38	Pearl Harbor	2,553	2,553	18H 7 M	1	6
(b)	6- 8-38	Pearl Harbor to Wake Island	2,300	2,300	16H 45M	1	6
(b)	6- 9-38	Wake Island to Hollandia, New Guinea	2,325	2,325	16H 13M	1	6
	8-31-38	Coco Solo	3,087	43,218	26H 40M	14	98
	9- 7-38	Pearl Harbor	2,553	43,401	17H 17M	17	119
	TOTALS			307,585		106	729

(a) Not including mass flights to Seattle and Sitka, Alaska.
(b) Flights of Richard Archbold's Commercial No. 3 PBY-2 Flying Boat "Guba."
(c) Flight of Sir Hubert Wilkins' Commercial No. 1 PBY-1 Flying Boat, over the Arctic Wastes in search of the lost Russian Trans-Polar fliers.

WRIGHT CYCLONES

Power the

CURTISS SBC-4

U.S. Navy

DIVE BOMBERS

Wright Cyclone engines power all of the latest Curtiss SBC-4 Dive Bombers recently ordered by the United States Navy.

Designed to Navy specifications to meet the rigid tactical requirements of Navy operations, planes of the Curtiss SBC-4 type are the Navy's standard Dive Bombers, based on aircraft carriers of the U. S. Battle Fleet.

Fighting planes of such superior design and performance as the Cyclone-powered Curtiss SBC-4 Dive Bombers have great striking force and are powerful Navy weapons for National Defense.

WRIGHT

AERONAUTICAL CORPORATION

PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

THE effectiveness of an aircraft in tactical defense depends upon the efficiency of both the machine and the pilot. Pilot fatigue, in a ship not easily maneuverable, can vastly lower the unit's striking power. Ball bearing equipped controls keep the ship easily maneuverable . . . the pilot's efficiency high.

Likewise the effectiveness of a supplier to the aircraft industry depends not on production alone, but upon the record of constant development, established results, experience in service.

Perhaps that is why virtually all ships purchased by the United States Army Air Corps and Naval Air Service are equipped with Fafnir Aircraft Ball Bearings at those vital points in control mechanisms where free, accurate movement is essential.

Because Fafnir recognized the need for aircraft bearing engineering and development, and pioneered with a separate aircraft division, more Fafnir Ball Bearings are used on American aircraft than any other make. The high bearing quality, the necessary seals and shields and lubrication provisions, the wide range of sizes and types have been *designed* and *engineered* in these ball bearings —not adapted as makeshifts for a vital job.

Write for the Aircraft Catalog, or for engineering help on your specific applications. The Fafnir Bearing Company, Aircraft Division, New Britain, Connecticut.

FAFNIR BALL BEARINGS

THE BALANCED LINE • MOST COMPLETE IN AMERICA

AVIATION'S OPERATORS CORNER

Tagging the Bases with

LES NEVILLE

Rochester Dedicates W.P.A. Hangar

Aldrich New N.Y.S.A.A. President

A MONUMENT to Harry Hopkins has been built at Rochester, N. Y. It is Hangar No. 3, at the Municipal Airport, dedicated late in September during the annual convention of the New York State Aviation Association. One of the two hangars completed under W.P.A. sponsorship, No. 3 is an example of what the energetic airport manager can do with W.P.A. if he goes about it in the right way and has his community behind him. And that is exactly what Rochester's able Manager Howard Shafer did.

Howard has been working overtime for a long while thinking up new ideas and many of them are built into Hangar No. 3. Among them are canvas covers to concentrate heat where it is needed to save heating the whole hangar; interior flood lights built into the side walls; flush type ground connections built into the floor at convenient intervals; and completely centralized heating and mechanical facilities. A clear opening of 140 ft. is provided and the main section is 34 ft. high and 156 ft. deep. Small side doors save opening the two main doors when smaller ships are taken in or out. Offices, machine shops, and hangar space for smaller ships are included in a lean-to on one side. Construction and fixtures are up to the minute. In directing the general improvements at the airport. Howard has had the cooperation of Harold S. McFarlin, Commissioner of the Rochester Department of Commerce.

Dedication of the hangar was part of a three day air meet with the Rochester Pilots Association acting as hosts. Participants included Roscoe Turner, Jacqueline Cochran, and Earl Southee, who brought up a team of soaring pilots from Elmira. Program was directed by E. B. "Count" De Lano.

LEGISLATORS BEWARE—Bob Aldrich, who has helped to keep New York's aviation tax free is new president of the N.Y.S.A.A.

QUARTER-OF-A-MILLION-DOLLAR-BABY — Rochester's Airport Manager Howard Shafer and his new hangar just completed under W.P.A. sponsorship for about $250,000.

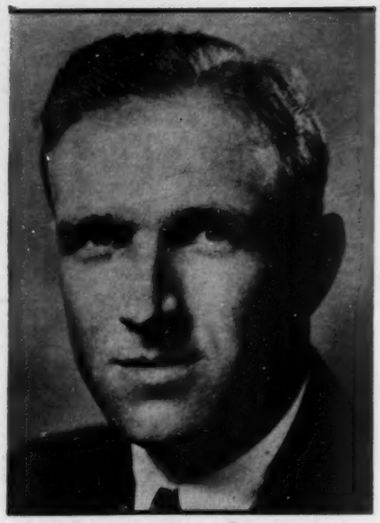
NEW IDEAS FOR N.J.S.A.A.—A. G. Norwood, new president, hopes to stimulate greater interest in the association. His Teaneck High School flying student, Patricia Thomas, was elected secretary.

The long fight against undesirable state legislation proceeds under the able direction of Bob Aldrich, Troy Airport manager and newly elected president of the New York State Aviation Association. But his thrice-elected predecessor, Max Pollet, will be right behind him in the vice-president's chair. This team has thrown fear into the hearts of many a politician in the last three years. Col. George Vaughan continues in the job he has done so well —secretary-treasurer.

Resolutions passed at the convention follow:

1. That State Police be adequately equipped and assisted in carrying out their assignment to enforce the State aviation laws.
2. That New York State aid the Federal Government in the W.P.A. air marking program.
3. That the N.Y.S.A.A. make every effort to prevent laws restricting flying on lakes or other bodies of water and to repeal present laws.
4. That State Publicity Bureau aid financially the Elmira Soaring Association in its 1939 meet.
5. That the State foster airport and landing trip facilities on state property.

A pocketful of orders was brought back from his first sales trip by Al Deming, new assistant sales manager for the Taylor-Young Airplane Company. Another addition to the sales force is Al Le Fevre, who is well known around the airports. New distributors include:



HEADS N.A.S.A.O.—Charles L. Morris, Commissioner of Aviation for Connecticut, has been made president of the National Association of State Aviation Officials, succeeding Col. Floyd Evans of Michigan.

Duck Air Services (Oakland, Calif.); El Paso Flying Service (New Mexico); Charlie Mayse (Douglas, Ariz.) Joseph Higgins (Wheeling, W. Va.) Midwest Flying School (Chicago, Ill.) Guido Gilardino, (Northampton, Mass.) Plains Airways, (Cheyenne, Wyoming) Frank P. Fall (Philadelphia, Pa.) Fritz Van Briesen (Sheldon, Iowa) Galinsky & Britton (Des Moines, Iowa) Cambria Flying Service (Patton, Pa.) Jas. D. Spear, (Pittsburgh, Pa.) Tommy Perkins (Cheyenne, Wyoming) H. Milligan (Sudbury, Ontario).

There's money in starting airports if you can avoid the temptation of deep pile rugs and million dollar administration buildings. No one knows better how to make it than our old friend Al Bennett, who has been responsible for starting a couple of dozen paying projects. Now Al wants to start them faster and he has a brand new subsidy idea to do it. He wants the government to issue coupons to each student permit holder, redeemable for $50 when he solos and $50 more after ten hours solo. These coupons could be pooled by pilots and used as collateral for the necessary funds to buy a ship for the group and start large numbers of small airports around the country. Hope you can sell it, Al.

Get your picture on the wall by stopping at the Odessa (Texas) Airport which has just been opened by Art Chase and L. N. Childress who lease the field from Ector County. Free transportation to town, twenty-four hour service, fuel, oil, hangar space, and a licensed mechanic are among the inducements.

Sam Breder tells us that he just appointed Beebe Air Service (Hastings, Neb.) distributor of Ryan S-C and S-T for the state, following conferences with Ray Beebe, president. First delivery went to Dr. E. C. Foote, Hastings private pilot. Miguel A. Zuniga, special sales representative of the Charles H. Babb Company, Ryan Agents, has left for a second trip in Central America.

A Campaign is being conducted by the Licensed Airmen of America, under the leadership of their president, P. E. Williams, to bring about a revision of C.A.R. 24. The group, which is composed of licensed pilots and mechanics of Southern California, seeks much more rigid requirements for mechanic ratings. Major proposal is that no mechanic rating be granted in future to any apprentice mechanic who has less than four years of actual aircraft experience. Other proposals are that apprentice mechanics must carry log books and have their work time certified much as pilots do, and that at least fifty per cent of workers engaged in the repair servicing, or overhaul of aircraft or engines shall be licensed mechanics. A petition embodying substantially these proposals has been signed by more than two thousand licensed mechanics and forwarded to Washington.

Committees have been assigned by C. F. Lienesch, president, Non-Scheduled Aviation, Inc., to the study of a number of projects including development of a code of fair practices for operators, a used plane Blue Book for used plane dealers, an inter-operator scrip plan for operators offering rental service, a plan to achieve better policing of such pilots and operators as do not respect existing regulations, a protest against enactment of a national uniform air insurance law; and a protest against the recent requirement of the C.A.A. that all non-scheduled operators must obtain certificates of convenience and necessity just as is required of airline operators.

Activities of the private fliers of the Aviation Country Club of California continued to hit a new high during California's autumn season. Twenty-three airplanes and about seventy-five persons attended an Aviation Country Club barbecue at Jack Crawford's ranch, Sunday, Sept. 25th, using Crawford's private airport. Planes on hand included eight Stinsons, six Fairchilds, two Wacos, two Monocoupes, a Travel Air, A Beechcraft, a Lockheed Vega, and two Douglas o-38s. On October 3rd a number of the more venturesome members flew to the mile-high airport on the edge of Big Bear Lake, in the San Bernardino Mountains, for a picnic lunch. More than one hundred private owner aircraft are scheduled to make the annual week-end tour to Del Monte October 15, and 16, from Los Angeles, San Francisco, and other points in California, Arizona, and Nevada. Organization of these tours has been under the direction of Ben S. McGlashan, club president, Bertrand Rhine, O. D. McKenzie, and Norman Larson.

REPORT CARD

Of Air School Developments

You can spin in and walk away as often as you want at California Flyers School of Aviation because they have just added a C-type Link Trainer to their equipment. And the Instrument and Radio Beam flying division is one of the busiest departments in the school. Two additional planes will soon be added to the fleet and mechanical, sheet metal, and drafting departments have been enlarged to accommodate the record enrollment.

A history making enrollment was reported for the Fall Term at Roosevelt Aviation School. Eighty-five students from ten states and three foreign countries constitute the class. New addition to the faculty is George Kuntz, formerly of Fleetwings and Sikorsky and a New York University Guggenheim School graduate.

Correspondence study courses of a new type have been established by the Westwood Correspondence School, of Los Angeles. The plan followed has been to have texts prepared by engineers and aircraft factory supervisors who have had charge of special study groups among factory employees. All material is presented in a practical way, eliminating entirely the study of theoretical subjects as such. Thus mathematics is dealt with only to the extent and in the way that it is used for aeronautical drafting and design work. Among the subjects covered by the new courses are Fundamental Aeronautical Drafting, Aeronautical Layout and Design, Strength Analysis, and Electrical Engineering. Recognized engineers have prepared the material.

Two new instrument schools have been established in the Los Angeles area. The pioneer Irvin Aircraft Instrument Schools has moved from its original location to a larger home in downtown Los Angeles. The school is under the direction of George Irvin and teaches aircraft instrument work exclusively. The school maintains a commercial instrument repair service.

On the other side of town, near Grand Central Air Terminal, Gene De Baud has established the American School of Aircraft Instruments, formerly known as the De Baud School of Aircraft Instruments. This school, devoted entirely to the training of men for specialized aircraft instrument work, has grown in three years from a small work shop to a large and completely equipped institution. All instruction is under the supervision of Gene C. De Baud, president, Gov't. Approved Instrument Instructor and formerly with Consolidated Aircraft Corp.

GIVE THIS MAN another hand!

One to hold the driver
One to hold the work
and a Phillips Screw
to hold itself

There's the Extra Hand

No other fastening device has pleased assembly men as much as the patented Phillips Recessed Head Screw which gives each man another hand, increases his production, reduces spoilage and eliminates screwdriver accidents.

ASSEMBLY TIME cut ½

Phillips' Screw users report substantial savings in production time as the result of changing from slotted-head screws to modern Phillips Recessed Head Screws. No time wasted with fumbled screws, pilot holes, crooked driving, broken heads, burrs and spoilage. There's no danger of the driver slipping from the recessed head — so faster driving methods are safe to use . . . spiral instead of hand, electric and pneumatic instead of spiral, or faster power driver speeds. No wonder a large part of the automotive and allied industries say "It's cheaper to drive Phillips!"

This is the genuine patented Phillips recessed head

. . . proven most successful for all types of industrial fastening.

Note the tapered recess in the screw — its angle was worked out after months of tests to determine the most efficient form of recessed head, utilizing the driver's *maximum* turning power. Note the flat surfaces — no curves except at the rim. That prevents the driver from burring the screw. Cold forged to tolerances of plus or minus .001" — to guarantee a perfect fit. 2 sizes of Phillips Drivers — available from leading manufacturers — fit 85% of all screw sizes commonly used.

PHILLIPS RECESSED HEAD SCREWS

Gain Time . . . Guide-Driver . . . Guard Work

U.S. Patents on Products and Methods Nos. 2,046,843: 2,046,837: 2,046,839: 2,046,840: 2,082,086: 2,084,078: 2,084,079: 2,090,388. Other Domestic and Foreign Patents Allowed and Pending.

MACHINE SCREWS / SHEET METAL SCREWS / WOOD SCREWS / STOVE BOLTS

Manufactured by

American Screw Co., *Licensor*, Providence, R. I. — National Screw & Mfg. Co., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass. — Parker-Kalon Corp., New York, New York
Corbin Screw Corp., New Britain, Conn. — Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N.Y.

Send Coupon for FOLDER B — containing at least a dozen ways Phillips Screws can lower your assembly costs. (Address your inquiry to one of the firms listed above.)

Name .....

Company .....

Address .....

Our Air Defense Problem

(*Continued from page 21*)

with auxiliary bases in the Virgin Islands and at the naval base at Guantanamo, Cuba, can protect the South Atlantic coast (perhaps least vulnerable of all coasts to aerial bombing, because of the agricultural nature of the country and the centralization of the more important industries at inland centers like Atlanta and Birmingham), and serve three other purposes: cover the approaches to the Panama Canal (our Defense Problem 2); aid in the defense of American island possessions in the Caribbean (Problem 5), and help to implement the Monroe doctrine (Problem 7). Within flying range of South Florida, it could effectively deny to any enemy (supported as it would be by naval and ground forces, and backed up by auxiliary bases in Cuba and Florida) the use of any of the West Indies or northern South American coast for air base purposes.

The base near Norfolk would effectively protect the Chesapeake Bay area and could assist in the protection of the New York-Philadelphia-Delaware Capes area, and the South Atlantic and New England areas. This base could dominate Bermuda and deny its use to any enemy.

Similarly a base in the New England area, preferably in Maine, would guard that industrial section and northern New York, and could also assist in the defense of the New York-Philadelphia-Delaware Capes area. Newfoundland and the Gulf of St. Lawrence (with their numerous harbors available for seaplane use) would be within its potential bombing radius; even Battle Harbor and Sandwich Bay in Labrador (the latter, used in the Balbo flight, offers, in Summer, one of the best harbors for seaplanes or flying boats, in the North Atlantic) could be denied to any enemy. James Bay and the southern part of Hudson Bay, as well as a vast area of Canada also would be within bombing range, and thus the North Atlantic aerial approach to this country from Europe would be adequately guarded.

The strategic areas of the West Coast and the entire coast itself can be adequately guarded by two or three main bases—one in the San Diego-Los Angeles area; one in the San Francisco area, and one near Puget Sound. Planes operating from these bases could dominate all of the West Coast from south of Cape Falso in Baja California to Alaska, and would thus not only be in a position to defend West Coast strategic areas, but could also assist in the solution of our Problem No. 4—defense of Hawaii, and of Problem No. 3—defense of Alaska. In addition they could assist the navy to control that vast sea area recently popularly known as the strategic triangle—Aleutians-Hawaii-West Coast.

Bases near New Orleans (or slightly further east) and near San Antonio, Texas, should be able completely to dominate, in cooperation with southern California bases, the Gulf of Mexico and Central American land and water areas as far south as the Gulf of Tehuantapec, which is also within range of our base at Panama (to be discussed later). The Mexican border is amply defended by such bases.

The important industrial triangle in the north—Pittsburgh-Chicago-Detroit—would be protected from direct overseas air attack by our coastal bases—particularly by our New England and Puget Sound bases. But there remains the possibility—faint, improbable, even fantastic—of air attacks delivered from a base established by an enemy in northern or central Canada, or even from water or land bases established on the edge of the Arctic ice pack in the Hudson Bay region. How the enemy would get there; how he could establish, maintain and supply his base is beyond the purview of this article; suffice it to say that there seems little real danger of air attacks of consequence from bases located in those severe latitudes of the North. However, not only to provide another safeguard to our most important industrial area, but more especially to establish a central mid-Continent base area from which any of our coastal bases could be readily reenforced, a base or bases in the neighborhood of Chicago, Minneapolis and St. Louis are indicated.

So much for the problem of serious, continuous air attack against our coasts and our strategic areas, a problem which cannot become acute for this country until air frontiers are rolled back and planes can easily leap the seven seas.

But the same bases, just described, together with auxiliary ones (to protect navy yards, coastal fortifications, etc.), should serve equally well to defend the country against sea and/or land atack. There is no great problem here; serious attack from the land, or sea, against the continental United States is not to be expected. Raids against our coasts, however, conducted either by fast surface vessels, by submarines or by planes launched from carriers, raids intended chiefly as weapons against the morale of the civilian population or to force the dispersion and hence the weakening of our defense forces, must be considered. It might as well be said at once that it is not possible with complete certainty to guard against such raids, just as it is not possible even today to prevent an occasional air raider from bases overseas from bombing our coastal regions.

It is certain that the next war will be brought home to America by bomb and explosive; the question is not how to stop such raids, for there is no absolute insurance against them, but rather how to localize and minimize their damage. Our great cities and our industrial areas will probably be the targets for such occasional raiders; auxiliary bases near navy yards and coastal fortifications should be particularly useful in defense against such itinerant enemies.

2. The Canal Zone

A most important link in the nation's strategical and commercial life, and yet a concentrated target for an enemy attack, the defense of the Canal presents problems not encountered elsewhere. Not that a few carefully placed bombs could wreck the Canal indefinitely. The Canal's structure—particularly its massive locks—are nowhere near as vulnerable to high explosive as one is led to believe from reading the Sunday supplements. The Gatun spillway, the famous earth banks at Culebra Cut, the power houses which operate the lock pumps and gates are more inviting targets than the locks themselves. Bombs carefully placed on any of these objectives *might*, if used in sufficient quantity, cause such damage as to block the Canal for days, or even weeks. Consequently the air defense of the Canal must guard—not so much against concentrated attack—but against itinerant raiders with far greater care than is necessary in the case of the air defense of the United States, for the rewards for such reckless daring at Panama are far greater.

Air bases on both sides of the Zone

(*Turn to page 70*)

SPERRY

Serves Them All

High above Manhattan three Douglas bombers of the Army Air Corps cruise majestically back to their base... three thousand miles away a close formation of Navy Voughts goes thundering down the California coast... far off to the South a Coast Guard Grumman takes off in a flash of glistening spray ... while three Marine Corps fighters speed away on flight maneuvers ... Powerful insurance for the safety of every American home!

In the cockpits of these and many, many other Government airplanes are Gyro-Horizons and Directional Gyros or Gyropilots—Sperry flight instruments, long recognized for their dependability in every branch of the Air Services.

SPERRY GYROSCOPE CO., INC.
BROOKLYN, NEW YORK

Air Defense Problem

(*Continued from page 68*)

are, of course, essential, but outlying auxiliary bases, so situated as to enable defending planes to intercept raiding planes or ships are of almost coequal importance. The Galapagos Islands and the Cocos Islands in the Pacific—are possible outlying auxiliary bases for seaplanes and would probably be so used in case of war, even though they do not belong to the United States. On the Atlantic end of the Canal the West Indian base at Porto Rico should be able effectively to guard the western sea approaches. However, to provide even greater security against swift surprise attacks from an enemy plane flying, perhaps, from a hidden field in Central or South America, or from a carrier far at sea, investigations should be started looking towards the establishment *in wartime* of defensive auxiliary bases near Cape Mala (Panama) which commands the Gulf of Panama, in Magdalena Bay (South America), the Gulf of Fonseca, Nicaragua, and the Gulf of San Blas and near Bocas del Toro, Panama. Such bases might well be established as a war measure after a consultation with friendly Central American countries.

3. Alaska

Alaska and its appendage of the Aleutians are important—not alone in their own right—but primarily because of their significance in the defense of the United States. A casual look at a great circle map of the Pacific will clearly show that the Aleutians, plus Hawaii, control the Northeastern Pacific. Hence adequate air bases in our great northwest are necessary. Main bases at Kodiak Island, and perhaps near Juneau or Fairbanks or Gustaffson's Point, with auxiliary patrol plane bases at Adak or other harbors of the Aleutians would amply protect Alaska and would also contribute to the defense of Hawaii.

4. Hawaii

Honolulu is some 2,100 miles from Dutch Harbor, 2,300 miles from San Diego, almost 1,000 miles from Kingman Reef, about 1,600 miles from Howland and Baker islands almost on the Equator, and about 1,200 miles from Midway Island almost on the International Date Line. It is the hub of our Pacific air defense and as such it should be the centre of our most powerful air base system in the west. Oahu, site of the naval base of Pearl Harbor, with the army's Luke, Wheeler and Hickam Fields, the navy's Ford Island and Kaneohe Bay (projected) has ample base facilities. But small auxiliary facilities should be established on the island of Hawaii, and it is obvious that to provide perfect security for the main islands of Hawaii, the enemy must be denied any possible bases within bombing range.

The navy's annual manoeuvres for recent years have been predicated upon the seizure of Midway Island by an enemy and the establishment there of an advanced base for further operations against Oahu and Pearl Harbor. To forestall any such possible attempt in case of war, small security points, or auxiliary bases, for the defense of Hawaii, should be set up (some are already under way) at Midway, Palmyra Island and perhaps also at Wake in the Western Pacific.

A further base has been proposed at Pago Pago, Samoa, but it is difficult to see the utility of a base so far south; strategically Pago Pago presents a considerable salient, and even the proposed outpost on Wake Island makes a jutting and provocative salient far out toward Japan, a salient which could not well be defended in that future day when the ranges of bombing planes approach infinity.

These island auxiliary outposts, adequately supplied with planes and backed up by the great resources and fighting strength of Hawaii, flanked on the north by the Aleutians, themselves bases, should not only enable us to maintain an aerial patrol line in mid-Pacific, but also insure our continued domination of the Northeastern Pacific—and, flung out towards Japan, they can be used to strengthen American foreign policy in the Western Pacific and to assist in the defense of the Philippines, one of the sub-heads under Problem No. 5.

5. Defense of Island Possessions

The Caribbean base, previously discussed, plus the bases at Panama, offer more than ample security for our political and economic investments in that troubled area, so our Caribbean possessions will be no further mentioned here.

But there remains Samoa, itself of no intrinsic value (the fine harbor of Pago Pago is largely lost upon the United States unless we were engaged in war with England or Australia—something so preposterously unlikely as to be beyond the purview of this article); there remains Guam, and above all the Philippines.

But the defense of the Philippines, as well as of Guam, is today primarily a problem of politics rather than of strategy. For the Philippines can be defended—let no one who shows you a Great Circle chart of the Pacific say you nay—but at a price which it is probably not worth while to pay. The Philippines are an exposed salient of American influence in the East, far removed from home, difficult to supply with the stuff of war, isolated behind a screen of Japanese islands, and now vulnerable—in some places—to an attack from Japan. Corregidor is probably impregnable indefinitely; other parts of the island could hold out for a long period, but eventually, unless the facilities and the forces now available there are considerably strengthened the islands would eventually fall.

American aviation strength in the Philippines is very weak, although flying fields, adequate for their present purposes, have been established under recent governors and army administrators from Batan in the north to Mindanao in the south. But the question that first must be decided—and it is a question intimately linked with the future of the Philippines themselves—is whether or not it is worth while for us to strengthen our forces there. If we elect to remain in the Philippines and to bear the burden of their defense, no half-way measures are possible; a great air base must be built on Luzon, the base at Wake finished, an intermediate one started at Guam. If we elect to leave the islands—and thereby lessen the likelihood of our involvement in war—our military forces, air, sea and ground, should be entirely withdrawn. The latter seems the wiser policy; the Philippines are not necessary to our economy or to our political prestige, and they are a strategic liability.

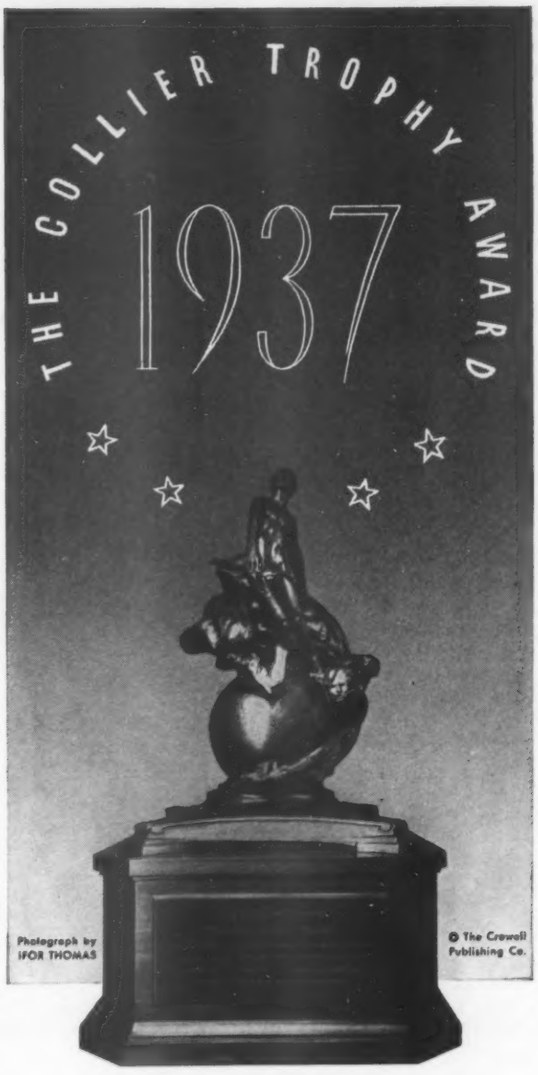
6. Protection of coast-wise and overseas commerce

The protection of coastwise and overseas commerce is, of course, the first concern of the Navy, but the air arm is playing—both in attack of, and defense of, surface ships a more and more important part. Control of the sea is essential if our commerce is not to be chivvied from the seas; in naval operations looking toward that end—operations which may be climaxed by a major fleet action—the aid of ship-based planes is vital. Our navy, with scouting planes, observation planes for

(*Turn to page 78*)

TO THE U.S. ARMY AIR CORPS

for the greatest achievement in aviation in America



Four times winner of the Collier Trophy, the U. S. Army Air Corps wins the 1937 award with the Lockheed XC-35 substratosphere airplane. Congratulations to these modern pioneers who have developed a new means of national defense and faster routes for air transport service.

LOCKHEED

LOCKHEED AIRCRAFT CORPORATION, BURBANK, CALIF., U.S.A.

REPRESENTATIVES THROUGHOUT THE WORLD

General Westover

General Arnold

General Andrews

General Foulois

Our Air Defenses—I. The Army

(*Continued from page 25*)

The price for not remedying the situation will be to drive some important manufacturers from Army competitions if not completely out of business. Only the fortuitous existence of a boom in exports has prevented it from already doing so.

What are the general type trends in AC procurement?

The Air Corps, properly, considers its ultimate plans for its air fleet as its own business. But a number of generalities is permissible. Basically America's fighting planes must meet the rather unique conditions imposed by the sheer mileage magnitude of our defense problems. Hence even our pursuit planes must have much greater range than the average European chase plane. Hence the increasing stress on long range bombardment. The Air Corps visualizes these war time assignments: concentrations almost overnight anywhere within the continental United States; reinforcement (by air) of Panama and Hawaii, attack upon enemy bases set up in Alaska, operations with the fleet against an enemy on foreign soil or approaching us by sea. All these things spell range—and of course big bombers—such as the Boeing B17s and XB-15. Just how big these will go will probably be fixed more through joint Army-Navy agreement than by technological limitation.

Beside long range bombing the Air Corps is aggressively building up its attack forces and is now service testing the twin engined Curtiss A-18s. The U. S. Army was among the first to develop a special type of plane for operations against ground troops and it shows no sign of abandoning that policy. In pursuit—after an experiment with two-place craft—the Air Corps seems definitely settled upon the single seater. Latest pursuit trends include a "service test" order of Curtiss pursuits equipped with the 1,100 hp. Allison liquid-cooled in-line engine.

In observation the North American 47-A is leader in quantity production contracts. For artillery spotting the Air Corps is trying out the mobile-captive balloon and also the autogiro. The basic trainers have led to the basic combat plane—a type of great utility in many conceivable types of warfare. But perhaps the most interesting trend sign of all is the Bell Airacuda combat fighter—something new under the sun—a twin-engined, cannon-armed slugger which can match speed and performance with anything. Thirteen are now on order. By 1940 it may have become a large element in the procurement plan.

We attach a table of orders made over the past few years by the Air Corps:

Five Fiscal Years of AC Shopping

Type	1934	1935	1936	1937	1938	Total
Pursuit.....	3	50*	77	4	236	370
Attack (1 eng.).	1	110	102	...	35	248
Attack (2 eng.).	...	...	1	13	...	14
Observation, ..	22	71	20	109	33	255
Bomber (2 eng.)	81	...	82	212	78	453
Bomber (4 eng.)	...	1	13	1	40	55
Basic Combat..	...	...	...	85	95	180
Basic Trainer..	...	30	82	150	...	262
Primary Trainer	...	...	26	72	20	118
Cargo.....	1	...	22	4	51	78
Autogiro.....	...	2	1	7	...	10
Combat Fighter	...	...	1	...	...	1
Amphibians....	...	...	...	5	26	31
Total.....	108	264	427	662	614	2,075

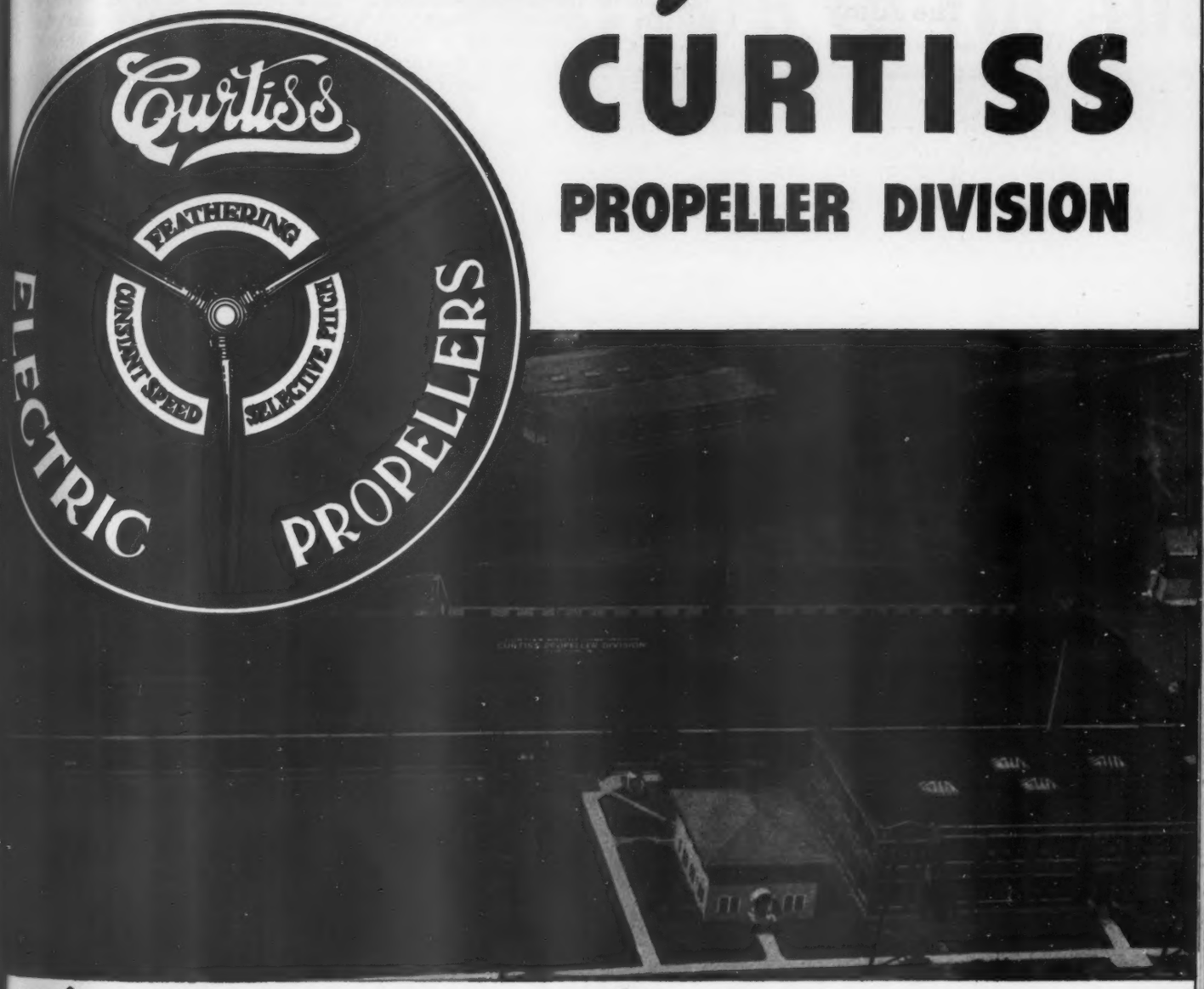
*Two Place

Planes form only one part of an air force. Is Air Corps manpower keeping abreast of its procurement program?

In order for the AC to proficiently perform its function, irrespective of the size and of the amount of appropriation provided, its various parts must be properly balanced. The Army has been increasing the number of its personnel, both officers and men as rapidly as possible within the limit of the relatively small amount of funds available. At the present time the airplane program is shaping up more rapidly than the personnel program, (and the personnel program more rapidly than the housing program). It is important that all of these march abreast of each other. From July, 1931 to July, 1936, there was a net gain of slightly more than 100 regular AC officers (from about 1,300 to 1,400). This despite the fact that the War Department authorization provided for the complement of 1,650 regular Air Corps officers. By the end of the fiscal year 1938, the number of officers in the Army Air Corps had been increased to 1,430. Last month some 200 more were added in a lump from those reserve officers (graduates of Randolph and Kelly) who took examinations in August. Next year the Air Corps hopes Congress will make appropriations for another 100. That seems to indicate a total regular army commissioned strength of about 1,750 by June, 1940. However, the estimated minimum need in this category for the estimated Air Force at that date is from 2,300 to 2,400 regular officers. To this should be added approximately 1,300 reserve officers on extended active duty, in order to provide adequate crews for the airplanes in the air and a proper complement of ground administrative supply and technical personnel. Congress has actually authorized 2,092

(*Turn to page 74*)

The New Home of the CURTISS PROPELLER DIVISION



Ten Outstanding Features of CURTISS ELECTRIC PROPELLERS

1 MANUALLY SELECTIVE PITCH AND AUTOMATIC CONSTANT SPEED CONTROL.

2 FAST FEATHERING WITHOUT RESTRICTION AS TO NUMBER OF FEATHERING AND UNFEATHERING OPERATIONS.

3 GRADUAL FULLY-CONTROLLED UNFEATHERING TO PREVENT DAMAGE TO ENGINE.

4 PITCH CHANGING SYSTEM ENTIRELY INDEPENDENT OF ENGINE.

5 UNIFORM OPERATION IN ALL TEMPERATURES.

6 UNLIMITED PITCH RANGE TO MEET ALL OPERATING CONDITIONS INCLUDING HIGH SPEED DIVING.

7 LIGHT WEIGHT.

8 INSTALLATION SIMPLICITY.

9 SINGLE-PIECE CHROME-NICKEL STEEL HUB WITH MULTI-BEARING BLADE RETENTION.

10 UNIT TYPE CONSTRUCTION FOR EASY DISASSEMBLY AND MAINTENANCE.

CURTISS WRIGHT CORPORATION
CURTISS PROPELLER DIVISION
CLIFTON, N.J.

The Army

(*Continued from page 72*)

regular Army officers and 1,300 reserve officers on extended active duty, but unless it makes further appropriations such authorization is meaningless.

Meanwhile the number of reserve officers on extended active duty should also be increased. The average in 1938 was 550. This year with the enrollment in the Training Center boosted from less than 450 to over a thousand, it is expected that the number of reserve officers on extended active duty will increase to some 857. Presumably there will be a further increase next year and the year following, etc., for practically all Training Center graduates are now ordered, with their own consent, upon graduation, to three years active duty with the regular Army. For one reason or another however (principally offers of good permanent jobs with the airlines or other areonautical activities) reserve officers average considerably less than three years' active duty. The minimum requirement as stated above is 1,300 as authorized by Congress. Previously to this time Congress has provided as much money for reserve officers on extended active duty as could be efficiently expended. With the great increase in the number of reserve officers available due to the expansion activities, the AC Training Center thinks that considerable additional funds should be provided by Congress to permit calling of all graduates of the AC Training Center to active duty for three years.

The present authorized enlisted strength is approximately 19,400. This is at least 5,000 below the minimum estimated 1940 requirements and should conditions change and the strength of possible invaders increase, an increase in the enlisted strength in the Army Air Corps would eventually become necessary.

Well, so much for planes and the men. What progress has been made in bases since the start of the New Air Corps?

Under the Wilcox Bill (which was an authorization act but provided no appropriation) the War Department as directed therein made a very complete study of the U. S. and Alaska. This bill, approved June 30, 1935, directed the Air Corps to proceed with surveys for seven modern air bases strategically located for the air defense of the United States as follows: (1) In the Atlantic Northeast, presumably New England; (2) In the Atlantic Southeast, or in the Carribbean; (3) In the Southeastern states; (4) In the Pacific Northwest; (5) In Alaska; (6) In the Rocky Mountains; (7) Possibly in the Middle West. The Army has duly carried out these surveys although it has made no public announcement of its findings.

So far, the only new air base on which construction is actually started is the Northwest air base at McChord Field. The development and improvement of Scott Field for GHQ headquarters fills requirement (7) for a midland base. Other than this Northwest air base at Tacoma, Washington, there have been no new fields purchased, donated, or improved specifically for fulfilling the plan. The organization of a branch of the AC School at Lowrey Field, Denver, Colorado, and the improvement of the landing field and construction of modern hangars, shops, barracks, etc., at existing Air Corps stations are scarcely believed to specifically fulfill the plan as contained in the bill. Looking at the broad strategical picture, it would seem that Congress might well soon consider funds for pushing the New England and Alaska bases.

Meanwhile existing Air Corps stations have been almost completely rebuilt. There are approximately 60 Army Air Corps stations or activities at which there has been some modern permanent construction. All of this number, however, cannot be considered air bases. Under the strict definition of the term there are only six of these which may be properly considered air bases for mobile units. (Langley, Mitchell, Selfridge, March, Hamilton, and Barksdale Fields). There are five AC schools, four AC depots, one of which includes an experimental division. The rest of these 60 stations are small establishments for furnishing air service to ground units, for providing facilities for reserve officers flying on inactive duty, etc. The foregoing does not include the 19 National Guard AC Stations. During recent years it is safe to assume that each and everyone of these 60 stations has been the scene of substantial improvements.

Relief funds are of course the prime factor. Just how much money has been spent on Army Fields by the CWA, the PWA and the WPA would be hard to extract from the maze of departmental bookkeeping. Probably it is no less than $35,000,000. In addition the Quartermaster Corps of the Army has itself added at least ten more millions. Can you remember the horrible old pasteboard houses that served air service posts like Mitchell Field for officers' quarters and barracks? Today Mitchell Field looks like something out of a portfolio of drawing for the Ideal City of the Future, and March Field in California in turn makes Mitchell seem prosaic. Hangars are huge, shops well appointed, landing fields have grown to size ample for almost any conceivable ship or weather condition. Runways have sprung up where only grass grew before. These are generalities but so is the picture general.

Added to that, one must not minimize the tremendous military asset in the recent improvement of America's transport and commercial fields. If there were no such fields the Army would have to create many of them. As military squadrons grow, the fact becomes more and more apparent that defense bases must be regional. It will be obviously impossible to handle more than a hundred or so military planes off a single airport. Danger from enemy attack will impose limitations if traffic problems do not. In actual warfare the GHQ would have to shift bases almost constantly. The military base problem, then is only partly that of having a few huge fields in each defensive region. It would need dozens of smaller fields in each area to supplement or even substitute for such bases in time of war. That the federal government alone has put $80,000,000 into the country's airport network during the past few years is in itself one of the most important military accomplishments of the period.

Epilogue

Plane for plane, man for man, base for base, the U. S. Army Air Corps has remade itself in the last three years into a fighting force that need admit no superior anywhere in the world today. But there is still much to do. Its fighting fleet must grow not only to the limits set for it by past boards of inquiry, but to limits made necessary by the ever-increasing pace of foreign air forces. Its personnel strength must be speeded in its growth amply to man its growing fleet. A few major strategic bases should be added to its assets. The Air Corps has shown it can carry forth its general assignment with an astounding speed and effectiveness—but continued and enlightened support from the public, the War Department, and Congress is more essential now than at any other time in our history.

A Famous Insignia TAKES TO THE AIR

A new Consolidated Airboat, flying the flag of American Export Airlines, Inc., will soon wing its way over the North Atlantic to foreign ports of call.

From the United States of America to important countries in Europe, Northern Africa and the Near East, this giant long-range flying boat will chart new paths in the air over and beyond routes of the famous American Export Lines, a hallmark of American shipping for the past two decades.

CONSOLIDATED Aircraft CORP.

SAN DIEGO • CALIFORNIA

ESTABLISHED 1923

Our Air Defense II. The Navy

(*Continued from page 29*)

This, of course, is only a drop in the bucket as far as actual base requirements are concerned. At a guess, it might take as much as 80 to 90 million dollars to provide adequate bases to meet the operational and maintenance needs of the proposed 3,000 plane program, but even such a huge expenditure could be more than justified in terms of the increased security it would afford.

For battleships and cruisers, aviation is an highly important auxiliary. The mission of the aircraft complement is to increase the effectiveness of ship on which it is based. Such aircraft need not carry any offensive armament as their major task is to spot gunfire for battleships, or to scout and observe over wide areas for the cruisers. Aircraft for these purposes are always catapult-launched, returning to their ships by landing in the water alongside and being hoisted aboard. The average cruiser or battleship today carries four seaplanes, usually biplanes of the single float type.

By contrast, the mission of carrier-based aircraft is offensive, constituting the Navy's aerial striking force against the surface ships and the aircraft of an ememy fleet. Carrier complements usually list between seventy and eighty airplanes, divided among fast high performance scouts, bombers and fighters.

Except for minor structural differences, such as stressing for catapulting and dive bombing, and the provision of devices to engage arresting gear on carrier decks, ship-borne aircraft do not differ materially from high-performance machines for general military use anywhere. The Navy has, of course, specific requirements in the way of special equipment to be carried, etc., and must take special precautions to protect planes and engines from destructive salt-water corrosion, but speed, maneuverability and the ability to carry a good military load are the primary requirements. Compactness (meaning minimum wing span, or the provision of means for folding wings) is an obvious necessity for ship or carrier work. This last consideration, incidentally, explains the past difficulty for the Navy to adopt the monoplane types. Improvement in design and performance, however, in the past few years have made possible the production of fast, compact monoplanes and the present trend is definitely in that direction. Some of the more recent orders, for example, for fighters have gone to Vought and to Grumman for monoplane fighters and the latest design bombers and torpedo planes (such as the new Douglas TBD-1's) for off-the-deck operations are all folding wing monoplanes.

The carrier situation at the present time is improving, although again we lack the proper number consistent with the minimum defense requirements. Three vessels, the Lexington, the Saratoga and the Ranger are already in the Fleet and two others, the Yorktown and Enterprise will join the fleet early in 1939. The Yorktown was commissioned on September 30, 1937, and the Enterprise on May 12, 1938. During the current year both have had extensive shake-down cruises and are now fitted out for active operation. Two additional carriers, the Wasp and the Hornet, are being planned for the immediate future.

As for the Marine Corps, its aviation activities follow the lines laid down above for the regular navy, except that it seldom engages in any long range PB work. With minor modifications, its flying equipment is the same as that employed by the Navy. Most of the M.C. units are shore-based, but detachments are sent to sea regularly on the carriers for training purposes.

Whether or not the Navy builds to the 2,050 plane limit or the 3,000 plane limit depends to a great extent upon the expansion of the surface fleet program. How far below either of these levels we are at the present time, however, is indicated by the fact that during the fiscal year of 1939 a total of 1,048 craft were available to the fleet with additional shore-based equipment to bring the active operating total up to 1,415 airplanes. Expected increase in numerical strength during the present fiscal year has been delayed due to the fact that average unit costs have gone up in the neighborhood of 28 per cent. These increased costs have been due to the general rise in the costs of material and to increased complication of accessory equipment required for each machine. In addition, labor costs have gone up materially due to effect of the Walsh-Healey act and the Social Security act. For example the estimated cost (on a comparable basis) for a patrol bomber under 1938 estimates was $163,452 and under 1939 actual conditions the cost per unit was $250,335. The net of this has been that instead of being able to purchase 397 aircraft with the $28,860,000 made available on the basis of July, 1936, estimates the total number has been reduced to 320.

The best indication of the trend of our present aircraft expansion is to work from over-all figures for the past three years. These figures are as given by Admiral Cook in his statement before the House Naval Affairs Committee when they were considering the appropriation for the current fiscal year.

No Navy equipment expansion program makes any sense without corresponding expansion in personnel. As it is, Admiral Cook pointed out when the 1939 appropriation requirements were aired that a serious pilot shortage existed under the present conditions.

It is estimated that we will be some 670 pilots short of requirements by the end of June 1939, for before that time

(*Turn to page 78*)

Appropriations for Naval Aviation—Dollars

	(Fiscal Years)			
	1939	1938	1937	1936
Navigational, Radio Aerological & Photographic equipment..	968,700	750,000	700,000	498,200
Maintenance and operations of aircraft and air stations	19,120,800	18,796,000	14,408,270	11,020,450
Experimental and Development	3,403,500	4,768,000	2,500,000	2,498,000
Aircraft Construction.....	24,582,000	27,186,000	20,080,000	26,715,660
Totals.....	48,075,000	51,500,000	37,688,270	40,732,310

NEWS FLASH!

New BEECHCRAFT biplanes can be insured for full **hull coverage** (including CRASH; FIRE under all circumstances; WINDSTORM, tornado and cyclone; LAND DAMAGE, collision and hail; and THEFT) for acceptable private-owner risks at an all-inclusive rate of

9.75%

Policies are standard repair and replacement forms and are written by one of the largest aviation insurance underwriting groups in the world.

This rate is a milestone in the private ownership and operation of aircraft. COMPARE! and write us for details or have your insurance broker or agent write us or Aero Insurance Underwriters.

Beech Aircraft Corporation

6411 EAST CENTRAL • WICHITA, KANSAS • U. S. A.

Our Air Defense Problem

(*Continued from page 70*)

spotting gunfire, dive bombers, torpedo bombers, and fighters and fighter-bombers is well equipped to establish air superiority above the seas in the one of action. Carrier-based planes are the key to such superiority; our present ratio of carrier strength must be maintained and even increased. Today we have five carriers built, one building and one planned against six built and five building for Great Britain; five built, one building and one projected for Japan; and two building (reputedly to carry 170 planes each) for Germany.

But it is not the problem of air cooperation with our surface fighting fleet that presents the most serious aspect of commerce protection.

For the technique of air defense or air attack of commercial vessels against lone, or mass raiders of the skies, or of the seas is entirely undeveloped in this country, and the air arm here offers a far more serious threat to our mastery of the seas than if its power were to be applied to attacks against fighting ships.

The bases described in the discussions of previous defense problems should suffice for the defense of much of our deep-sea trade, although not for attack upon the enemy's trade. The first requires an extension of the aerial convoy system superficially developed in the World War. Blimps and airships could be of some service as patrol ships in these operations—particularly to warn surface craft against submarines. Long-range patrol planes also are probably indicated for coastal work, but it will also be necessary, particularly where the surface convoy is relatively far from harbor or aircraft base, to provide a flying fleet that will be ready to spring to instant protection of the surface merchant ships in case of an enemy raid *in force* from the air or from the sea. The British Admiralty is turning to specially built anti-aircraft ships for such convoy protection work. Another indicated solution is the conversion of old freighters, tankers, liners, into makeshift carriers able to house a squadron of fighting planes, which could constantly maintain their own air patrol above the lumbering surface ships. Such convoy carriers, which need not be of high speed since their only duties would be with slow merchant ships, would be particularly useful in that long stretch between southern California and the Panama Canal, where our intercoastal trade would be furthest removed from our own harbors and air bases, and most exposed to enemy attack.

For air commerce attack against enemy trade, our suggested Pacific bases (many of them already actualities or "live" projects) are admirably placed for interrupting all trade east and west across the Northern Pacific; our Caribbean bases are admirably suited for interrupting foreign trade to the Caribbean area and to Central and Northern South America, and our Atlantic bases would be able to dominate all trade routes approaching our own and Canada's east coasts. But for operations further afield, floating bases —carriers—are for the time being essential. Improvised carriers, such as those suggested for commerce protection purposes, or a catapult ship, like the German mother ship, Schwabenland, might be useful commerce raiders, although their utility is clearly inferior to that of a fast surface raider. An ideal combination might be the proposed flying-deck cruiser type—much talked of but never built.

7. Foreign policies and our overseas interests

The naval flying force is well prepared and well developed. The GHQ Air Force of the army has set up the nucleus of a splendid organization, equipped primarily, it is true, to defend our own shores. But if our involvement in an overseas war were to require the services of part of our GHQ planes abroad, there is no adequate tactical or administrative provision for such employment, nor are there available, as yet, sufficient planes for such service. An overseas wing, or even a second GHQ Air Force, somewhat similar in organization to the one at home might have to be created in order to provide the organization able to undertake strategical air missions overseas.

Army cooperation duties—vital in any such overseas war—would require considerable more study and development than are now given to them. The use of the autogyro, advanced thought on the use of planes for artillery observation; the use of attack aviation with ground troops; the possibilities of combined air-mechanized attacks—all these things require far more study and exploitation.

But war is not the only forceful instrument of foreign policy, nor is it the only way in which to protect our interests overseas. More and more, air power is becoming an international police weapon; an instrument of foreign policy; witness the threat of its use in the recent Czechoslovakian crisis, its actual use in Palestine and along the Indian frontier. We know little of such uses of air power, nor have we, as yet, we may be thankful, any occasion for so using it. But the day may come when either for domestic or foreign disturbances the police powers of the air will become important to us; its possibilities should be studied now.

The Navy

(*Continued from page 76*)

it will be necessary to provide aviation personnel for two new cruisers of the Scouting Force, and for the new carrier "Wasp." To partially alleviate the existing shortage, the Navy has taken into the active service a number of aviation cadets from the Naval Reserve. Present estimates indicate, however, that a sufficient number of aviation cadets will be available to fill these vacancies, and also to provide for attrition.

This has been written in the midst of the recent German-Czech crisis in Europe. Rumors have been coming in hourly of mobilization of fleets and air forces. At the moment, it seems that a peaceful solution has been found for the present situation. But in a world that is as close to the brink of war as we are we cannot shut our eyes to the need for the building up of our own defenses. We are just beginning to realize officially how vast and how far the countries of Europe have progressed in their armament programs. In the past few years a lack of funds for our naval establishment (in spite of the increase shown in the above table) has seriously hampered building up for our minimum defensive requirements. Unless this fact is recognized by the next Congress and more funds made available immediately, the position of the United States in aeronautic affairs may be seriously jeopardized.

Curtiss

ENLARGES PRODUCTION FACILITIES

Curtiss Army P-36A Pursuit

Curtiss Navy SBC-4 Dive-Bomber

Curtiss Army Y1P-37 Advanced Pursuit

3 NEW BUILDINGS

Speed up production for National Defense

Production at the Curtiss Aeroplane Division, Buffalo, New York, has reached a new high. Three new buildings and an extension to the office building have enabled an advantageous rearrangement of manufacturing facilities which has made possible a sharp increase in production.

The National Air Defense plans of the United States Government have created a demand for deliveries of aircraft at a more rapid rate. Curtiss has met Government requirements by building up an organization to produce all-metal, high-performance fighting planes on a larger scale than they have ever before been produced in the United States.

Curtiss is now building large orders of Curtiss P-36A Pursuit Planes —the Standard Pursuit Airplanes of the U.S. Army Air Corps; Curtiss SBC-4—the Standard Dive-Bombers of the U.S. Navy; and Curtiss Y1P-37 Pursuits—reputed to be the fastest military airplanes in the world. Orders recently completed include Curtiss SOC-3 and SOC-4 Standard Scout-Observation Planes of the U.S. Navy and Curtiss A-18 Standard Twin-Engined Attack Planes of the U.S. Army Air Corps.

CURTISS AEROPLANE DIVISION • CURTISS-WRIGHT CORPORATION
BUFFALO *"The Pioneers of Aviation"* NEW YORK

Curtiss

PRECISION-BUILT ARMY AND NAVY AIRCRAFT

"Index Finger" D-F

(*Continued from page 49*)

The receiver itself is an entirely new design especially developed by RCA for use with this direction finder in transport service. The circuit line-up is indicated in the accompanying diagram. The shielded loop feeds a push-pull input stage into which a 90-cycle modulating voltage is injected. In the output of the push-pull stage there appear, therefore, two 90-cycle sidebands, which reverse in phase as the loop is turned from one side to the other of its null position, and which are completely balanced out when the loop is on the null (when the plane of the loop coincides with the received wavefront). These side bands are then mixed with the carrier received from the auxiliary sense antenna, and the carrier and 90-cycle sidebands are thereafter amplified in a conventional superheterodyne. In the output of the second detector of this superheterodyne, the audio channel is split up two ways. One branch feeds headphones for aural monitoring, identification of station call-letters, and for standby use in the remotely-possible case of failure in the indicator circuits. The other audio circuit passes through a filter which removes all modulation except the 90-cycle component, which is present only when the loop is off the null position. The 90-cycle output of the filter then passes through control circuits which drive a small motor geared to the loop itself, thus rotating the loop. Since the direction of the motor rotation depends on the phase of the voltage fed to it, which in turn depends on whether the loop is the right or left of the null, the motor always tends to rotate the loop in the direction of the null. When the loop reaches the null position, the modulation is balanced out, the driving motor receives no excitation and the loop stops rotating. If the loop is moved from the null position by any cause, such as changing the heading of the ship, the motor again comes into play and drives the loop back to the null position. This motor action operates continuously whenever the loop is off the null position and always in the direction to restore the loop to the null position. Consequently the position of the loop is maintained continuously at right angles to the direction of the incoming wave. A flexible shaft connects directly from the loop shaft to the pointer on the compass card. Thereby, the pointer is caused to point in the direction of the station then being received.

Needless to say this description of the operation of the equipment omits troublesome details. In the first place it is necessary to maintain the modulating voltage very close to 90 cycles, else the 90-cycle filter will introduce phase-shift errors. A vibrator supply having a natural vibration period at 90 cycles is used, and gives satisfactory performance without the need of frequency regulation.

One of the important features of the system is the fact that the motor drive is "dead beat," that is, as the loop nears the null position, the rotation slows up and comes to rest exactly at the null position without overshooting the mark. Ordinarily such "follow-up" mechanisms have a tendency to hunt, that is to wander back and forth each side of the null position.

The problem of rain-static has not been overlooked. A switch is provided which removes the sense antenna (on which most of the rain-static is picked up) from the circuit, and substitutes a second shielded loop mounted on the motor operated shaft at right angles to the null loop. Continuous headphone signal is provided by the pick-up of the second loop, which is maintained at the position of maximum intensity on the reference station. With the second loop in the circuit, the D-F operates automatically as before but without resolving the 180-degree ambiguity which is typical of all loop systems. The advantage is that the rain static interference is greatly reduced, and the usefulness of the compass is curtailed only to the extent that it indicates only the line on which the station is located, rather than its direction from the plane. Both the loops are mounted within a streamlined housing of conventional size and shape. The gross weight of the equipment is less than 75 pounds, and the power requirements are 120 watts, maximum, or 10 amperes from a 12-volt supply.

The Sperry engineers have so designed the equipment that it can be coupled directly to the Sperry gyropilot for controlling the direction of flight with reference to the received wavefront, entirely without attention from the pilot. It is possible also, of course, to receive the broadcast and beacon band stations on the sense antenna alone, using the headphones, for weather and beacon information, and broadcast programs. Likewise the loop may be rotated independently of the received signal, if desired, by controlling the motor from an auxiliary knob. This permits flight by the aural-null method, using headphones as the indicator.

Absolute Altitude

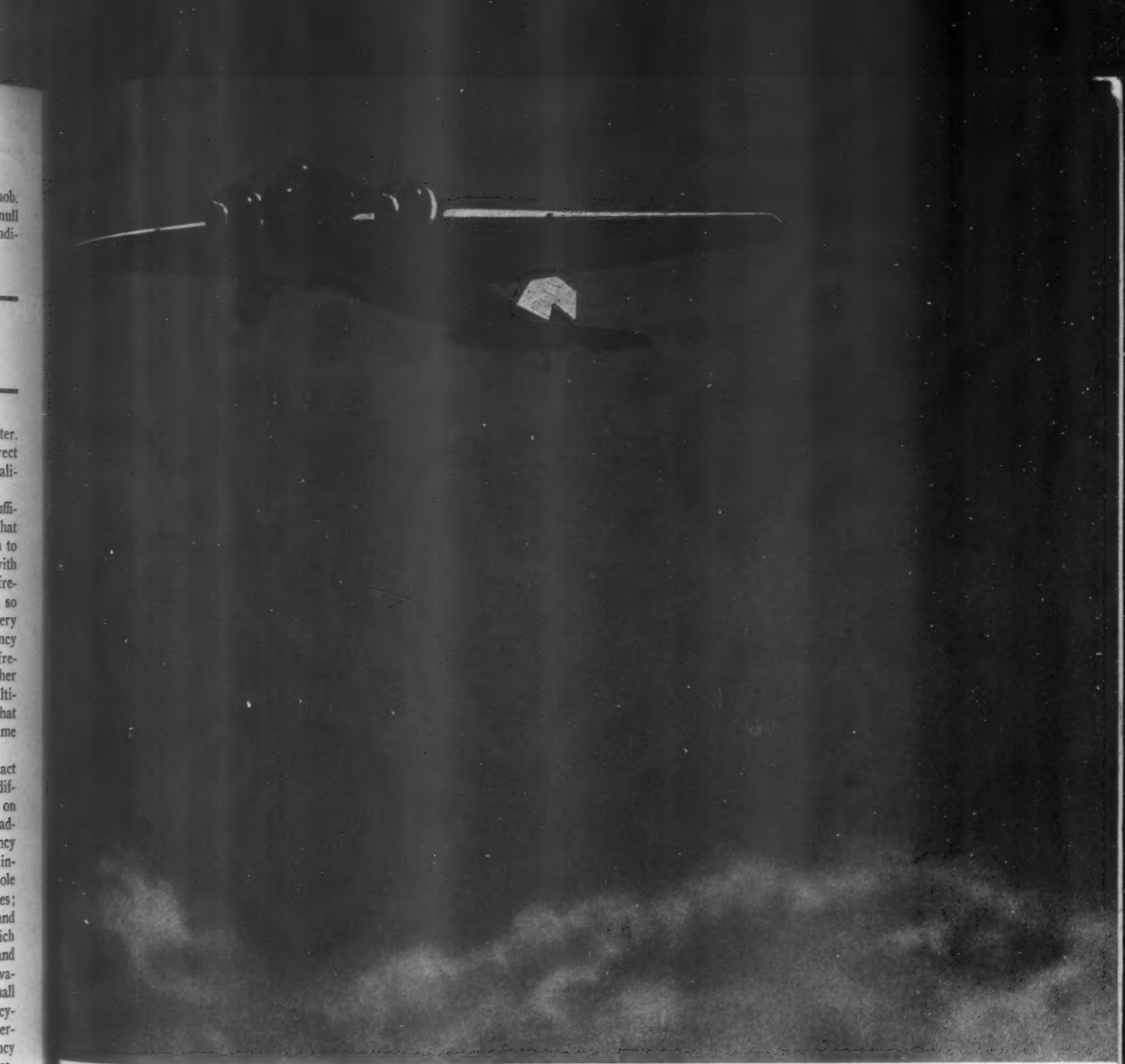
(*Continued from page 49*)

a deflection on the frequency meter. Thus the indications of the direct reading frequency meter may be calibrated directly in feet.

In such a system, of course, sufficient power must be radiated so that the reflected wave is strong enough to produce a detectable beat note with the under-wing signal. Also the frequency swing must be large enough so that the beat note produced at very low altitudes is not so low in frequency that it cannot be handled by the frequency meter. Also, on the other hand, the beat note at the upper altitude limits must not be so high that it cannot be measured by the same frequency meter.

It should be noted that the exact value of frequency used makes no difference, since the device operates on frequency difference only. The advantages of the very high frequency are, first, the high directivity obtainable from the waves with simple dipole and metalilc reflector structures; second, the freedom from static and other forms of interference which these high frequencies display; and third, the ability to obtain wide variations in frequency from a small percentage change in the frequency-determining source (since a small percentage variation in a high frequency must necessarily take in a large frequency band). The high frequencies do involve important problems, however, such as the stability of the circuits, both receiving and transmitting, the amount of power which can be generated and radiated, and sensivitity of the receiver, all of which suffer when the frequency is increased to the ultra-ultra high region above 300 Mc.

Whether or not this system is the one employed by the United-Western Electric device, the demonstration proved conclusively the practicability of a wave-reflection altimeter between the limits of 20 feet and 5,000 feet, absolute altitude. And for this achievement no small credit is due to the radio engineers of both companies who overcame the problems connected with it.



ERITAGE . . . This newest—and greatest—Martin Bomber has back of it the heritage of more than years' specialized experience in producing the world's most famous bombardment aircraft. This newest artin greatly excels even its own famous predecessors. It is now available for export. We invite inquiries om interested governments. THE GLENN L. MARTIN COMPANY, BALTIMORE, MARYLAND.

Builders of Dependable *Aircraft Since 1909*

TRADE MARK

★ MARTIN 166 ★

REMOVABLE, REPLACEABLE FELT SEALS

AS *Pioneered* BY NORMA-HOFFMANN FOR *Aircraft* CONTROLS

ARE ECONOMICAL AND EASY TO INSPECT AND REGREASE

While these seals are FIXED against accidental displacement, they are REMOVABLE and REPLACEABLE at will, easily and quickly. They facilitate regreasing and inspection. No snap rings are used. This seal, together with cadmium plating of exposed surfaces, gives NORMA-HOFFMANN AIRCRAFT CONTROL BEARINGS complete protection against the elements and foreign matter. * * * * They are available in a number of series, both single and double row types—all combining extreme sensitiveness with utmost rigidity, and eliminating frictional resistance, "jamming", and wear.

Like many other fundamental aircraft types, these Removable Felt Seal Control Bearings were originated by NORMA-HOFFMANN, and are extensively used in U.S. Navy and commercial aircraft.

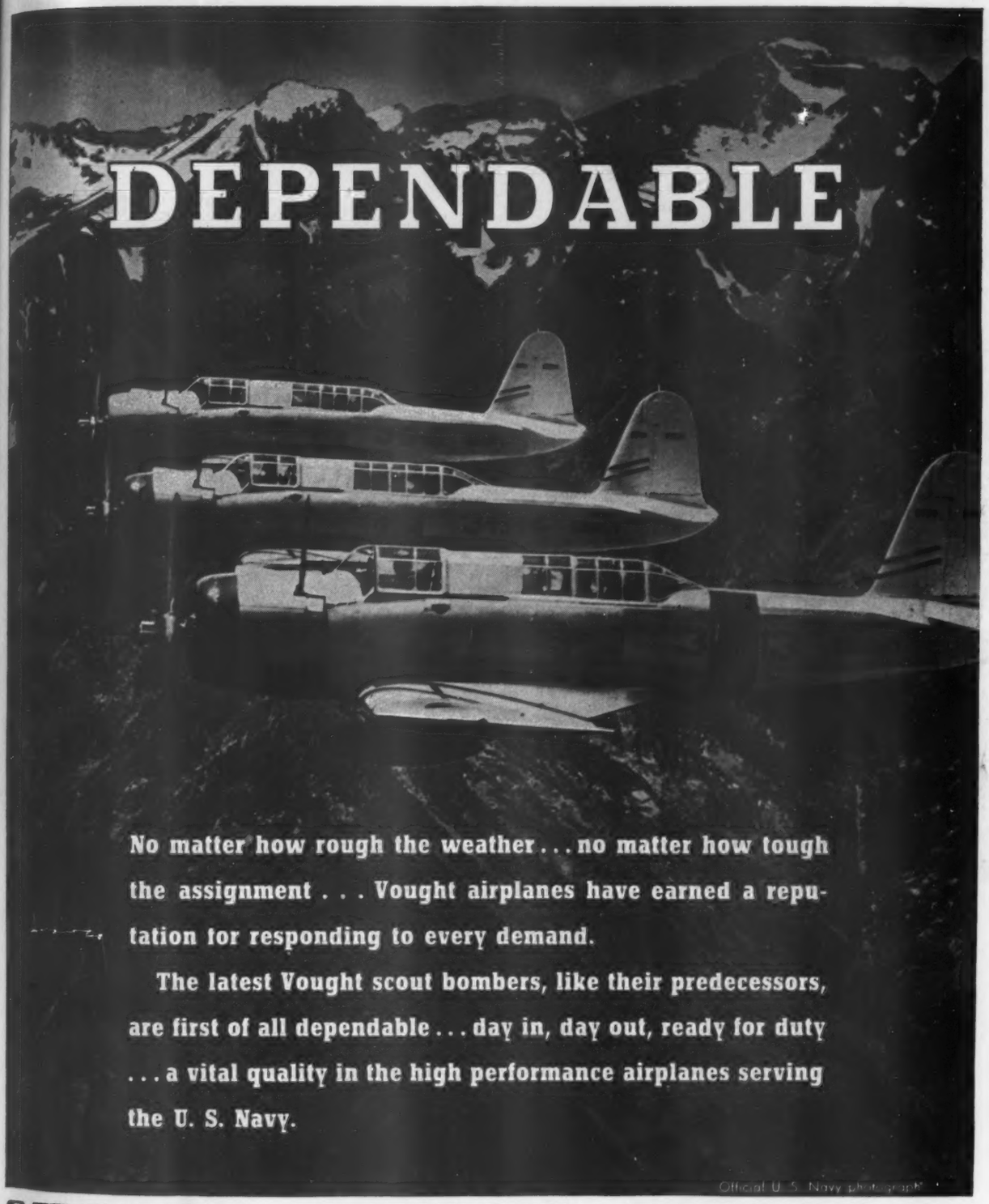
Write for the Catalog. Let our engineers work with you.

"NORMA-HOFFMANN"

PRECISION BEARINGS

BALL ROLLER THRUST

NORMA-HOFFMANN BEARINGS CORP'N., STAMFORD, CONN. U.S.A.



No matter how rough the weather . . . no matter how tough the assignment . . . Vought airplanes have earned a reputation for responding to every demand.

The latest Vought scout bombers, like their predecessors, are first of all dependable . . . day in, day out, ready for duty . . . a vital quality in the high performance airplanes serving the U. S. Navy.

Official U. S. Navy photograph

CHANCE VOUGHT AIRCRAFT

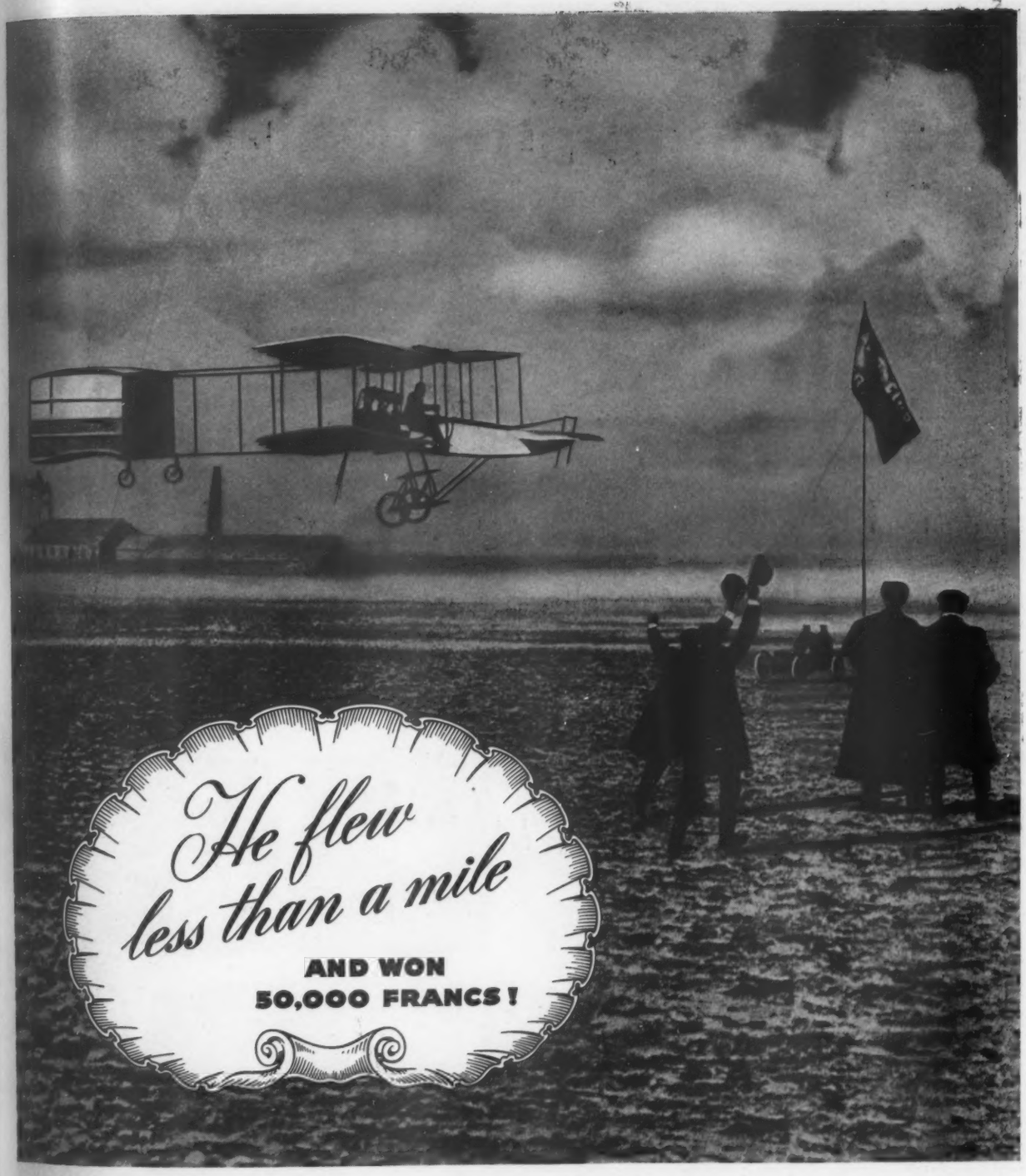
EAST HARTFORD • CONNECTICUT

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION

PUMP ENGINEERING SERVICE CORP.

12910 TAFT AVENUE ★ CLEVELAND, O.

Fuel Pumps • Vacuum Pumps • Hydraulic Pumps • Electrical Motor-Driven Units • Combination Pumps • Anti-Icing Pumps
Propeller Feathering Pumps • Hydraulic Motors • Primers • Accessory Drive Gear Boxes • Oil Separators
Relief, Fuel, Hydraulic, and Check Valves • Special Products Built to Customer's Specifications



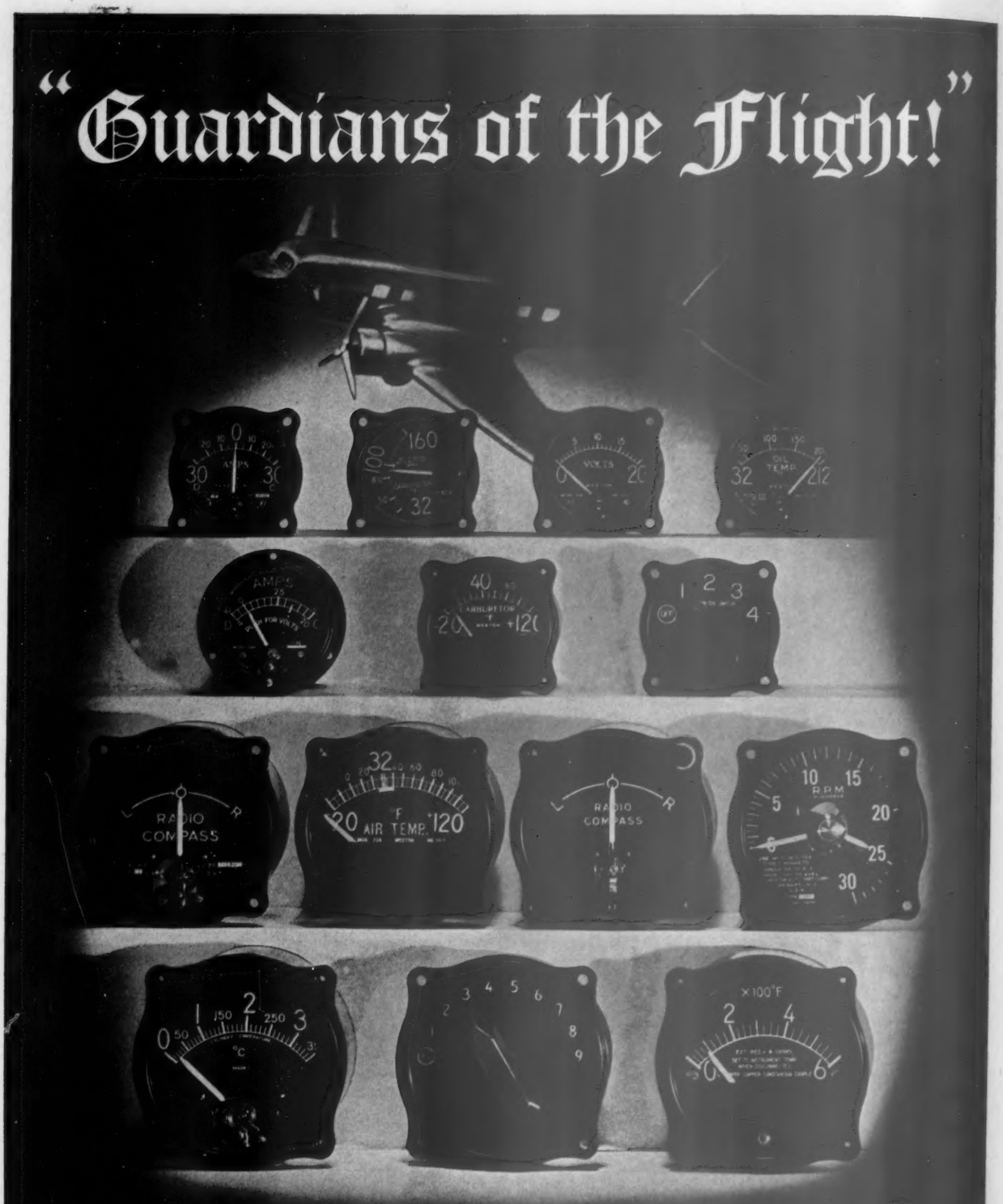
SOUNDS like a lot of money for a maneuver that every pilot and plane makes regularly today —the "bank and turn." Henri Farman pocketed this small fortune because he was first to prove it *could* be done. In 1908, he flew a measured French course of 500 meters, turned in air and flew back. He had accomplished the impossible!

Compare Farman's historic flight with that of two Japanese who in May of this year flew a closed circuit course at Kisarazu Airport, covering 7,233 miles without stopping or refueling.

Through steady improvements of fuels and engines, aviation has conquered a hundred "impossibles" since 30 years ago.

What records will be broken in the next 30 years cannot be predicted. But advances in aviation must continue to come from the steady improvement of fuel and engine. It is with this aim that Ethyl engineers are daily aiding in research so that aviation will always have available fuels that permit further progress. Ethyl Gasoline Corporation, Chrysler Building, New York, N. Y.

"Guardians of the Flight!"



WESTON *Aircraft Instruments*

AIR TEMPERATURE INDICATORS · OIL TEMPERATURE INDICATORS · CARBURETOR TEMPERATURE INDICATORS
BLIND LANDING INDICATORS · RADIO COMPASS INDICATORS · CABIN TEMPERATURE INDICATORS · CYLINDER
TEMPERATURE INDICATORS · ELECTRICAL TACHOMETERS · AMMETERS · VOLTMETERS · VOLT-AMMETERS

WESTON ELECTRICAL INSTRUMENT CORPORATION, 600 FRELINGHUYSEN AVENUE, NEWARK, N. J.

NOTHING FINER CAN BE SAID OF ANY AIRPLANE

Than, It Is—

AVIATION MANUFACTURING CORPORATION, LYCOMING DIVISION, WILLIAMSPORT, PA.

PLANES TAKE OFF QUICKER AND LAND SAFER WHEN EQUIPPED WITH

AEROL STRUTS

★ There must be sound reasons why more planes are equipped with Aerol Struts than any other type of landing gear. These reasons center around their air-and-oil principle of operation and their superlatively rugged construction.

First of all, Aerol Struts insure that the plane gets into the air more quickly because it can accelerate more quickly without hazardous ground shock.

Secondly, in military service, they insure safer landings particularly in emergency fields and damaged airfields because their resilient action absorbs even severe landing shock and minimizes nosing-over or ground-looping.

Thirdly, they have the advantage of uniform resiliency regardless of whether the plane is loaded or light.

Fourthly, over a 12-year period, they have proven their merit under all temperatures and operating conditions—in the temperate zones, tropics, and at both the north and south poles.

Aerol Struts may be engineered into any plane. We will be glad to send you complete information and offer the services of our engineering department.

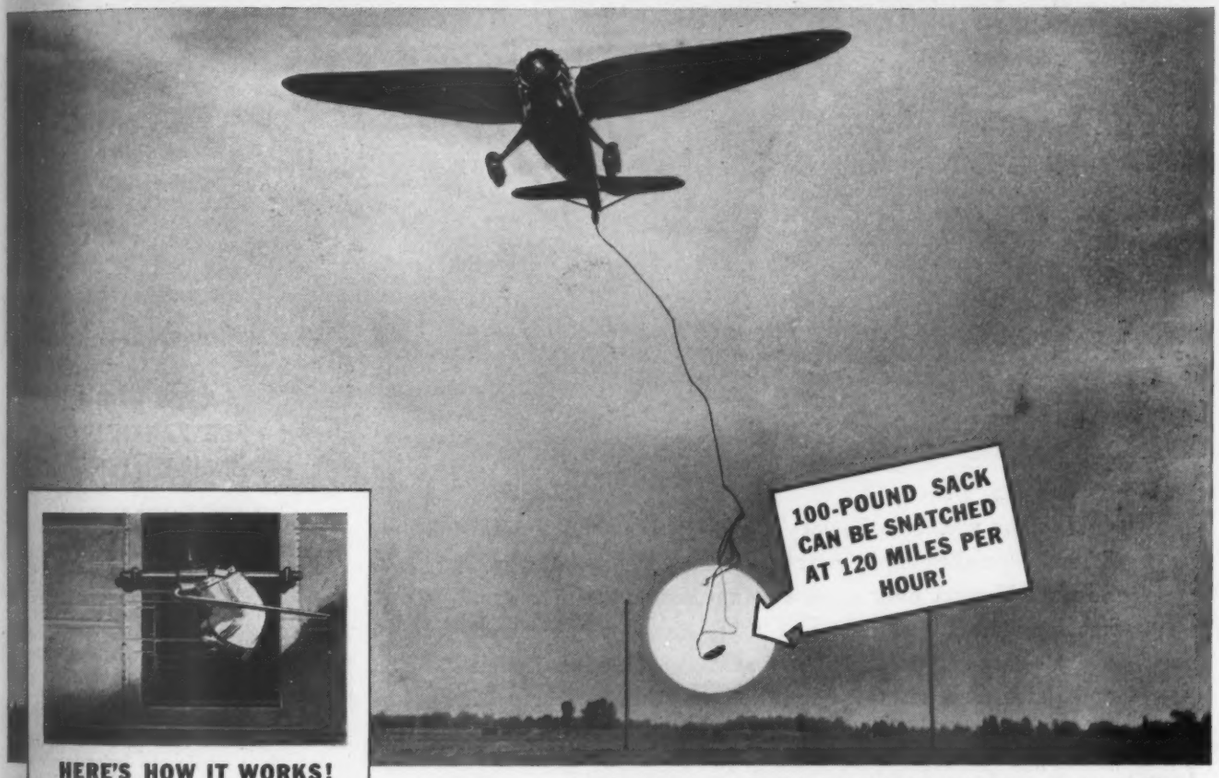
THE CLEVELAND PNEUMATIC TOOL CO.

CLEVELAND, OHIO, U. S. A. **Cable Address—"PNEUMATIC"**

AEROL *shock absorbing* STRUT

STINSON SCORES AGAIN!

FLEET OF STINSON RELIANTS TO GIVE DAILY AIR MAIL "PICKUP" SERVICE... MARK NEW ERA IN AIR MAIL PROGRESS!



HERE'S HOW IT WORKS!

The principle of the pick-up device is just like that on railroad mail cars which grab mail bags "on the fly." And the benefit in bringing fast air mail service to smaller communities is equally parallel.

NOW... STINSON RELIANTS PICK UP AND DELIVER MAIL WITHOUT LANDING!

STINSON helps open a new and revolutionary advancement in air mail service! A new fleet of Stinson Reliant planes are the first ever built to incorporate air mail pick-up and delivery facilities as part of their basic design.

Now it is possible for small communities to enjoy direct air mail service. No airport or landing field is necessary. Stinson Reliants with this new device can pick up or deliver mail "on the fly." Even fragile objects are picked up and delivered from planes in flight without damage.

The fleet of new Stinson Reliants, which will go into the first air mail service of this kind on two new air mail routes, have been ordered by All American Aviation, Inc., of Morgantown, West Virginia.

STINSON IS THE NATION'S FIRST CHOICE 4-5 PASSENGER CABIN PLANE!

More Stinson Reliants are used today by airlines, sportsmen, businessmen, overseas customers and state and government agencies than any comparable American plane! And no wonder! Write today for the illustrated folder which gives complete details on the new Stinson Reliant. In writing, please indicate the type of power plant—Lycoming (245-HP and 260-HP), Wright (320-HP), Pratt & Whitney (440-HP and 450-HP)—in which you are interested.

Write Today for Further Information

Stinson

AIRCRAFT DIVISION, AVIATION MANUFACTURING CORPORATION,
WAYNE, MICHIGAN, U. S. A.

●Whether you fly a Taylor "Cub" or command a giant Sikorsky—make certain your controls are made by Hazard. Because Hazard, ever since aviation became an industry, has supplied control cables or strand that have answered every safety requirement. At first it was Hazard's tinned and galvanized aircraft cables. More recently, Hazard's "KORŌDLESS" preformed cable (made of 18/8 stainless steel) has gained full recognition not only with the Navy, but all builders of craft which might encounter the problem of corrosion.

For certainty of performance, for positive control, for absolute safety of control operation, specify Hazard Aircraft Cable. It is made by the people who, for many years, have been "In Business for Your Safety."

HAZARD WIRE ROPE DIVISION
ESTABLISHED 1846
AMERICAN CHAIN & CABLE COMPANY, Inc.
WILKES-BARRE, PENNSYLVANIA
District Offices: New York, Chicago, Philadelphia, Pittsburgh, Fort Worth, San Francisco, Denver, Los Angeles, Atlanta, Tacoma

A FEW OF THE 137 AMERICAN CHAIN & CABLE INDUSTRIAL PRODUCTS

AMERICAN CHAIN DIVISION
(DOMINION CHAIN COMPANY, Ltd., in Canada)
Weed Tire Chains • Welded and Weldless Chain • Malleable Castings
Acco-Morrow Lubricators

ANDREW C. CAMPBELL DIVISION
Abrasive Cutting Machines • Floformers
Special Machinery • Nibbling Machines

FORD CHAIN BLOCK DIVISION
Chain Hoists • Trolleys

HAZARD WIRE ROPE DIVISION
Lay-Set Preformed Wire Rope • "Korōdless" Wire Rope • Preformed Spring-Lay Wire Rope • Guard Rail Cable

HIGHLAND IRON & STEEL DIVISION
Wrought Iron Bars and Shapes

MANLEY MANUFACTURING DIVISION
Automotive Service Station Equipment

OWEN SILENT SPRING COMPANY, Inc.
Owen Cushion and Mattress Spring Centers

PAGE STEEL AND WIRE DIVISION
Page Fence • Wire and Rod Products
Traffic Tape • Welding Wire

READING-PRATT & CADY DIVISION
Valves • Electric Steel Fittings

READING STEEL CASTING DIVISION
Electric Steel Castings, Rough or Machined
Railroad Specialties

WRIGHT MANUFACTURING DIVISION
Chain Hoists • Electric Hoists and Cranes

In Business for Your Safety

HAZARD *Aircraft* **CABLE**

★ THE AMERICAN EAGLE PROTECTS ITS NEST ★

In this world of present uncertainties Douglas is proud of its major part in building up U. S. air forces to adequate strength ☆ Built with the same precision as U. S. military planes are Douglas commercial transports. In world-wide airline use these planes are rendering a universal travel service that has no parallel in transportation history ☆ For national defense—for airline service depend on Douglas. Douglas Aircraft Co., Inc., Santa Monica, California

DOUGLAS

Specify -

B ★ A ★ 30

THE MOST UNIFORM AERONAUTICAL FABRIC ON THE MARKET

Horizontal testing machine used to test fabric breaking strength. One of many determinations in the production of Aeronautical Fabrics.

It must be understood that the mechanical processing of any raw agricultural product, such as cotton, is still somewhat of an art as well as a science because of annual crop variations.

However, in the production of B★A★30, through research, equipment, and method, the knowledge of the scientist has supplemented the skill of the artisan to such a degree that we may confidently offer our line of Aeronautical Fabrics and Tapes to the trade as the MOST UNIFORM of their kind on the market. This consistent performance is only possible under the best production conditions where every operation from raw material to finished goods is subject to careful laboratory check and control.

WELLINGTON SEARS COMPANY, 65 Worth Street, New York

DISTRIBUTORS

Garrett Supply Company, 1126 Santa Fe Avenue, Los Angeles, California

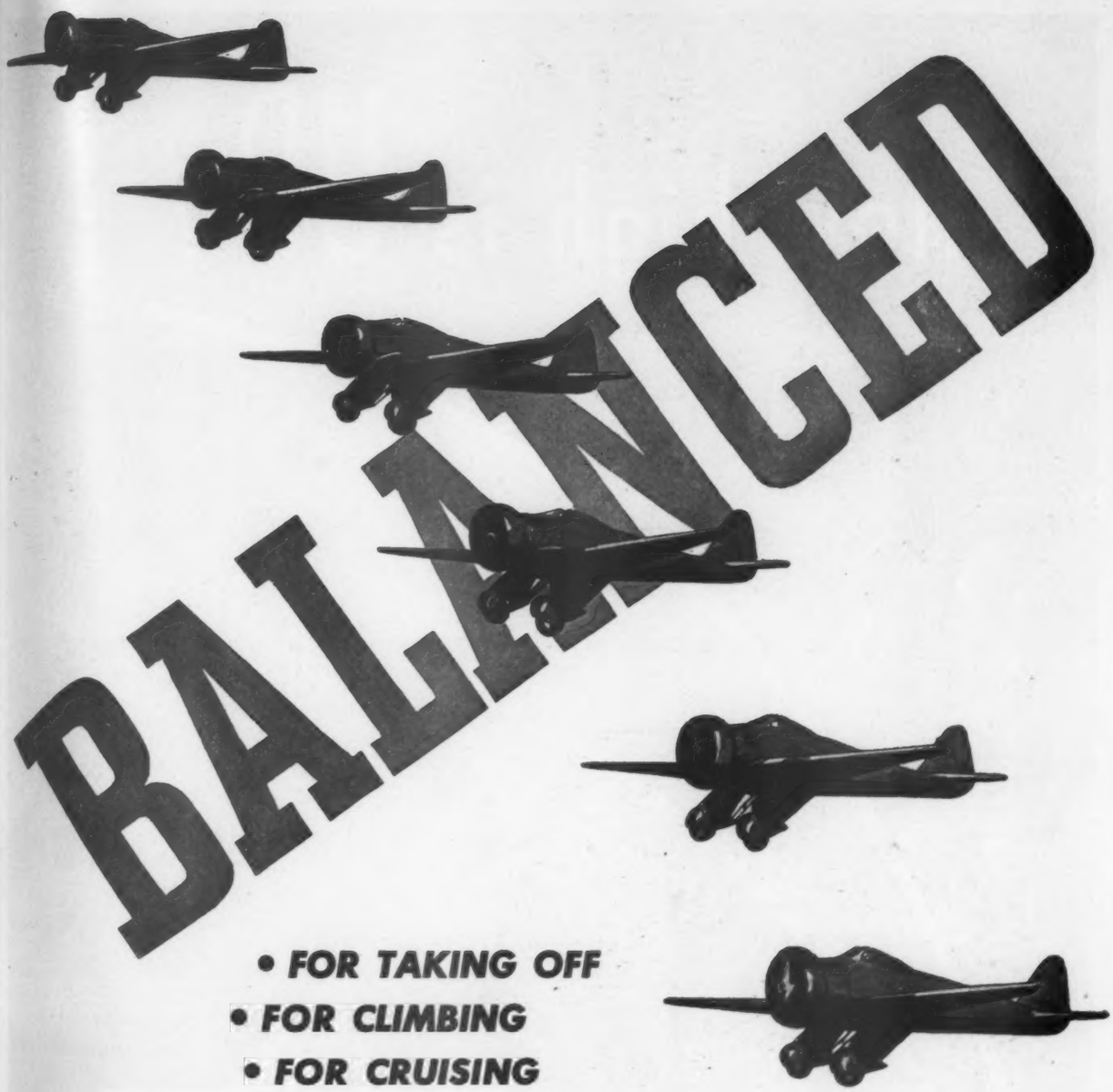
Bredouw Aeromotive Corp., Kansas City, Missouri

Fleet Aircraft of Canada, Ltd., Fort Erie, Ontario

SOUTH AMERICAN AGENTS

Mr. C. K. Trunbull, Bmé Mitre 430, Buenos Aires, Argentina

Mr. G. H. Vignal, Rua Buenos Aires, 68-2 Rio de Janeiro, Brazil



• FOR TAKING OFF
• FOR CLIMBING
• FOR CRUISING

EXPERIENCED PILOTS know that a *balanced* gasoline means better all-round performance . . . economical warm-up, quicker throttle response, greater cruising range.

Shell research has developed for you *balanced* aviation gasolines with octane ratings from 73 to 100. This new balanced fuel means quicker starting, more "revs" during the take-off and climb, and, in addition, lower fuel consumption.

For complete information on any of Shell's line of aircraft petroleum products, write to the Shell Aviation Department, Shell Building, San Francisco, California; or Shell Building, St. Louis; or 50 West 50th Street, New York City.

SHELL

AVIATION GASOLINES

How high is UP?

You can't fly cross country at sea level! That's why Menasco builds supercharged engines. In racing, too, it takes supercharging to "get there." That's why Menasco was the unanimous choice of Greve Trophy racers at Cleveland. For private flying or closed course racing, Menasco means championship performance.

MENASCO MANUFACTURING CO.
6917 McKINLEY AVE., LOS ANGELES, CALIF.

MENASCO

ENGINES WITH A STOUT HEART
50 H.P. TO 260 H.P.

SIKORSKY *Flying Dreadnaught*

Giant patrol bomber—
superb weapon of
national defense—now serving
THE UNITED STATES NAVY

SIKORSKY AIRCRAFT

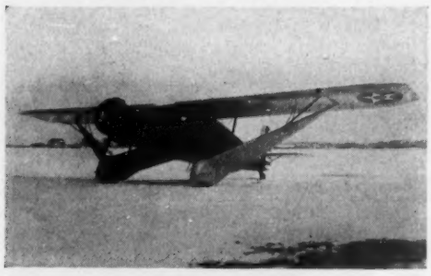
BRIDGEPORT, CONNECTICUT

ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION

BELLANCA ACHIEVEMENTS
First and Only Non-Stop Trans-Pacific Crossing—Japan-United States.
World's Non-Refueling Endurance Record 84 Hrs. 33 Min.
World's Distance Record—1931—5011 miles, New York-Istanbul.
Fastest Trans-Atlantic Crossing—Newfoundland-Ireland, 9 Hrs. 15 Min.
First Non-Stop Passenger Carrying Flight—New York-Germany plus many more outstanding trans-oceanic and endurance flights.

BELLANCA

Model 28-110 — High Performance FIGHTER-BOMBER



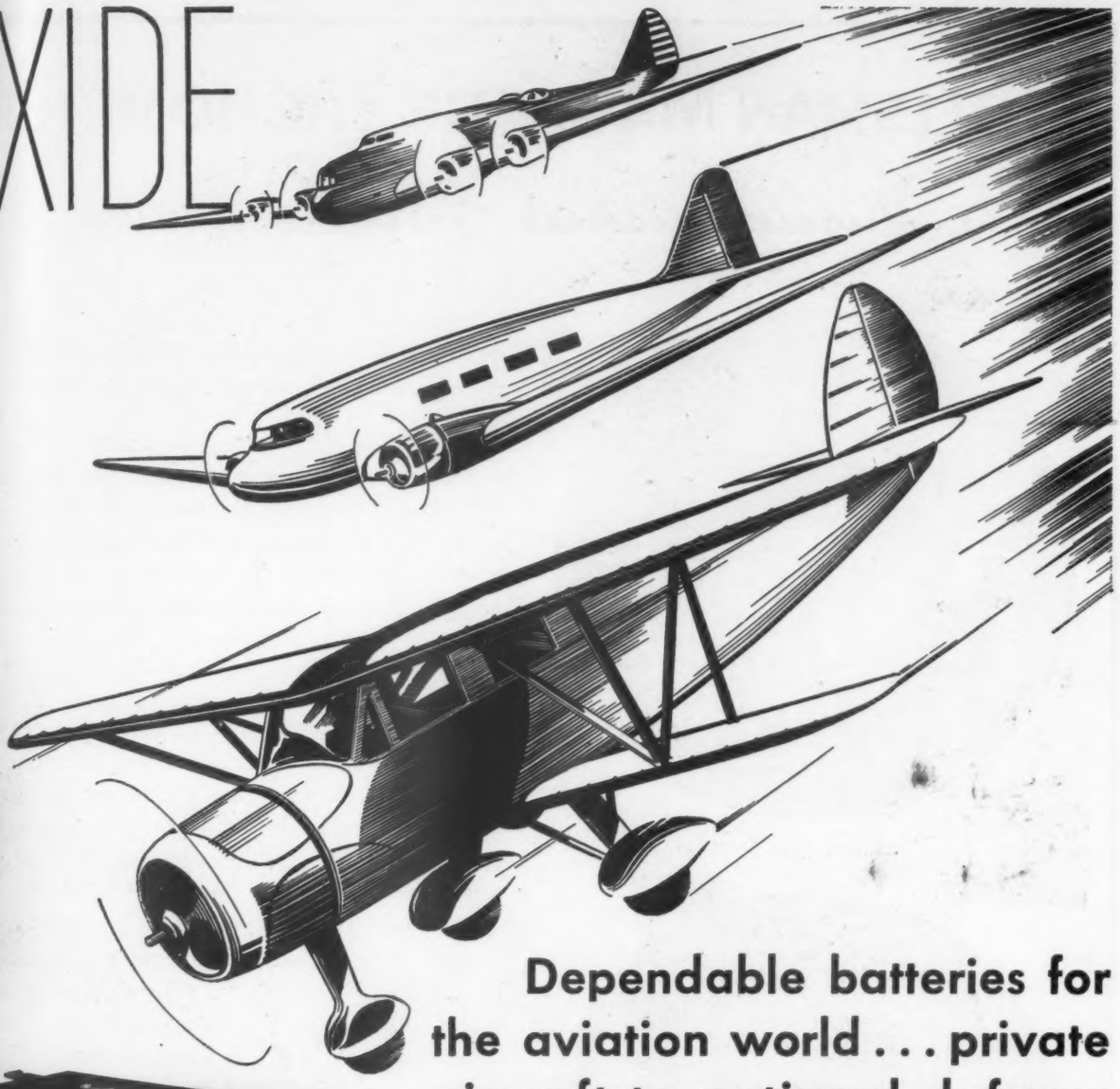
Bellanca Model 66-70 Ambulance & Troop Transport: Carries 18 soldiers as a high speed troop transport or, as an ambulance, accommodates 6 patients on litters. Has extreme utility as cargo carrier, with accommodation for carrying large-sized aircraft engines, or over two tons of payload.

★ Outstanding as a single-seat pursuit, two-seater fighter or bomber, the Bellanca Model 28-110 carries five machine guns (4 fixed and 1 flexible) and 1600 lbs. of bombs. Maximum speed 291 m.p.h. with Pratt & Whitney C Series Twin Row Wasp. Climb as Single-Seat Fighter 3800 feet per minute. Range from 800 to 1600 miles, depending upon load and speed. Subject to prior sales, this versatile craft can be delivered at a rate of two or more units per day on a production basis. Forty-two machines of this type have already been produced.

BELLANCA AIRCRAFT CORP'N.

New Castle • Delaware, U.S.A. • Cables : "Bellanca"

EXIDE



Dependable batteries for the aviation world . . . private aircraft to national defense

EXIDE Batteries fly the airways of the world. From the first aircraft battery in 1917, for ignition only, to the light-weight heavy-duty, integrally shielded non-spill assembly of today — Exide Aviation Batteries have kept abreast of the exacting requirements of the industry.

For national defense, air transport, ships of business executives, and sportsman pilots, these batteries offer dependability and safety in full measure. There is an Exide available for every type of ship, for use in every field of air service.

Exide integrally shielded battery, especially adapted for military aircraft.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia

The World's Largest Manufacturers of Storage Batteries for Every Purpose

Exide Batteries of Canada, Limited, Toronto

Exide
AIRCRAFT BATTERIES

To mark the fiftieth anniversary of Exide Batteries, a handsome souvenir booklet has been prepared, illustrating the essential part these batteries play in daily life. Write, and we will gladly send you a free copy.

KOLLSMAN MAGNETIC TACHOMETERS

Distinguished For Accuracy

Standard Type

Sensitive Type, with Kollsman Rim Lighting

» Exceptional accuracy, easy reading, and rugged construction distinguish Kollsman Magnetic Tachometers, available in both standard and sensitive types.

» Mounted on the instrument panel, with a large open scale that facilitates quick and easy reading, the Kollsman Tachometer is accurately calibrated to indicate the speed of the crankshaft within 10 r.p.m., from 1,000 to 3,000 r.p.m. Temperature compensation, rugged and precise, maintains this accuracy to within ¾ of 1% throughout a temperature range from —30° to +40° C.

» The materials used, and the method of construction, give this tachometer extreme accuracy. The indicating mechanism runs entirely on natural sapphire bearings, in a dust-tight compartment, insuring smooth and frictionless operation. The magnetic rotor, the heart of the instrument, is constructed of Alnico, a recently developed alloy steel of high magnetic strength and permanence. The geared drive for the rotor is sealed in a separate housing in the case and is lubricated with a special low freezing-point grease. *No wear can take place that will impair the accuracy of the indication.* And although this tachometer employs a powerful magnet, there is no external field, and hence no effect on a magnetic compass.

» Kollsman Magnetic Tachometers have S.A.E. standard drive shaft connections; are provided with straight or angle outlets to meet all installation conditions; have radium-luminous pointers and dials, and can be equipped with Kollsman Electric Rim Lighting.

» Specifications and more detailed information will be gladly supplied on request.

KOLLSMAN INSTRUMENT CO., INC.

8008 FORTY-FIFTH AVENUE . . . . . ELMHURST, NEW YORK

WESTERN BRANCH: GRAND CENTRAL AIR TERMINAL, GLENDALE, CALIFORNIA

VULTEE

V11-GB ATTACK BOMBER

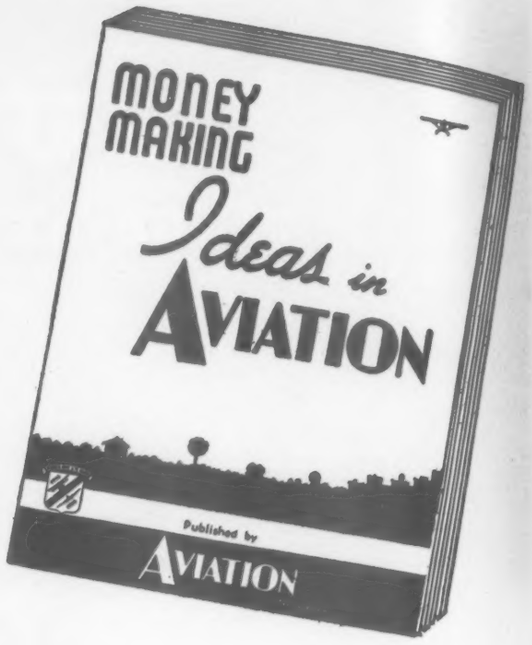
VULTEE AIRCRAFT

Division Aviation Manufacturing Corporation

DOWNEY · CALIFORNIA · U.S.A.

Going Places In 1938?

Then Let This FREE BOOK Help You



NEWCOMER or old timer—you will find practical, tested ideas in the pages of this book, specially compiled by the editors of AVIATION to meet the needs of Students, Pilots, Mechanics, Plane Owners, Fixed Base Operators, Transport and Airport Men. It is yours, without cost, with your subscription to AVIATION—the monthly issues of which bring you equally practical ideas for making your way in your chosen work.

While we call the book "Money Making Ideas" it's not a mere collection of ways in which to earn cash. It is filled with fresh, inspiring ideas that are self starters for live wire men. It's the kind of a book that encourages you to head for the top—by showing you how other men (many with such handicaps as no money, small town locations, etc.) have forged ahead and realized their aviation ambitions.

If you're just starting out—if you're experienced but feel you're in a groove—if you're impatient to get ahead *faster* —this book and the monthly issues of AVIATION can help you with these aims. Thousands of our readers who started with us as students are now important men in the world of flying. They claim that the all round coverage and information brought them by AVIATION has helped them to advance. This same material can help you. And the cream of much of it is contained in the pages of "Money Making Ideas" which comes to you free.

Forward MARCH In Your Flying Career . . . with AVIATION and this 128 page, practical book

Dollars from Photography—How to Buy a Plane on $20 a week income—Finding Jobs for Students—Ideas for Charter Service—Fixed Base Problems and Income —Instrument Training from Scratch—Flying Under the Hood—How An Airplane Opens the Door for the Salesman—The Low-Priced Airplane — Maintenance Kinks and Short Cuts—Trends in Sightseeing, Photography, Dusting—Aircraft at Work, as Told by users of Business Planes—and many other articles for everyone interested in the flying industry.

To get your *free* copy of "Money Making Ideas in Aviation" simply use the handy form below. Every paid-in-advance new or renewal subscriber may have a copy of this helpful book, without cost. Send only the regular subscription fee—$3, one year, $4 two years —and your book will come to you at once. There may be just the ideas you need in the pages of this book. Let it, and the monthly issue of AVIATION help you go places in flying. Get your copy at once by filling out the convenient form below and mailing it to us NOW.

Attention: Present Subscribers

You may obtain a copy of this FREE book by renewing your present subscription. *Regardless of when your present subscription expires,* you must send in another PRE-PAID renewal order. Your subscription will be extended for additional time without duplication. Mail in your order and payment today.

[All books are sent out by express to insure safe delivery. There is a small charge of 15c—payable to the expressman upon delivery of the book.]

Mail this Coupon at Once!

Aviation, 330 W. 42nd St., New York, N. Y.

I enclose $4. Enter my subscription to Aviation for two years and send me "Money Making Ideas in Aviation" free. I'll pay expressman 15c delivery charges.

( ) If renewal order, please check here.

( ) For 1 year subscription enclose $3 and check here.

Name .....

Address .....

City .....*State* .....

Company .....

Position 9-38

This Offer Good Only in United States, Possessions and Canada.

STEARMAN TRAINERS

Selected by the United States Army Air Corps for initial flight training of new pilots who aspire to fly such mighty aerial defense weapons as the giant 4-engine Boeing Flying Fortress. Stearman trainers are also the choice of the United States Navy and many foreign governments for primary and advanced student training.

STEARMAN AIRCRAFT
DIVISION OF BOEING AIRPLANE COMPANY
WICHITA, KANSAS

Another Great Contribution to Aircraft Safety

FOR many years, aeronautical engineers have tried to evolve an accurate means of measuring the vibration stresses in various parts of airplane propellers. Now Hamilton Standard has done it . . . with revolutionary effect on aircraft design.

By a surprisingly simple method, stresses are measured accurately at any given point on the blade or hub, and faithfully recorded on an "Oscillograph Record" as shown above. Thus changes in design leading to increased efficiency and reduced weight can now be made with the certain knowledge that the stresses involved do not exceed safe operating limits.

But that is not all. Through the new technique, the source of these troublesome vibration stresses, usually originating not in the propeller, but in the engine or some other part of the airplane, can be definitely determined—and promptly corrected.

Thus Hamilton Standard again makes a vital contribution to the science of flight.

HAMILTON STANDARD PROPELLERS

EAST HARTFORD, CONNECTICUT

One of the four divisions of United Aircraft Corporation

"Expert — for the professional . . . Simple — for the layman."

THESE ARE THE BOOKS THE AIRMEN USE to make themselves BETTER, SAFER FLIERS

PUBLISHED with the stamp of approval of leading figures in the entire aviation industry, this comprehensive, practical, 2-volume aviation library has been hailed with delight by men who pilot, build, maintain, or dispatch airplanes. Simply written and lavishly illustrated, these books give you modern flying from the ground up—from basic principles through the latest technical developments of instrument flying, in words and pictures. They are written and illustrated by experts. Both are yours, boxed, at an amazingly low price.

by ASSEN JORDANOFF

Pilot, instructor, engineer, technician and technical adviser to leading American airlines and manufacturers since 1921.

THROUGH THE OVERCAST

The Art of Instrument Flying

C. R. Smith, President of *American Airlines, Inc.*, says: "This book has taken the subject of meteorology out of the mathematical equations and has made it simple enough so that the average person can understand it. In addition, the author has explained instruments, as well as radio and all allied subjects, through a series of pictures, so thoroughly that it will help not only the professional airmen, but the fledglings as well to grow bigger and faster wings."

Over 300 illustrations make everything crystal clear in this book—the first complete and practical work on what has been incorrectly called "blind flying". Experienced pilots have hailed it with delight, because it gives in words and pictures accurate descriptions of the function and use of all the wonderful new instruments that are just now being installed in planes to make flying better and *safer*. Size 7" x 9½", 356 pages.

JUST PUBLISHED

YOUR WINGS

A FAMOUS book on the art of modern flying, which has, in less than two years, been translated into 7 languages, and been bought and used by tens of thousands of aviators in France, England, South America, Russia, Central Europe and the Far East. Thousands of copies now in use at the new Tennessee State aviation schools. Standard text in leading aviation academies throughout America. *Over 400 illustrations.* Size 7" x 9½" 231 pages.

☛ Either *Through The Overcast* ($3.00) or *Your Wings* ($2.50) are available singly from any bookseller, Air Associates, Inc., or from the publishers at the above prices per volume. See coupon at right for special mail offer. ☚

A PRACTICAL COMPLETE AVIATION LIBRARY IN 2 VOLS.

Everything from basic principles of flying through the newest developments in navigation, meteorology, engines, instruments, radio, aerobatics, instrument flying, military and scheduled airline aviation — completely described in *words and pictures*, by experts.

TOGETHER, BOXED, ONLY

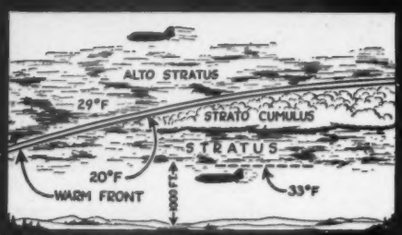
$5.00 *Indexed Illustrated*

You pay nothing if not satisfied.

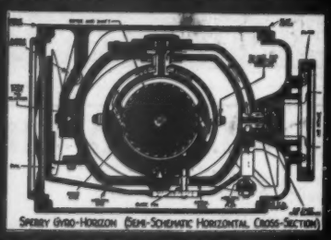
SEND NO MONEY

Just sign and mail coupon. When books are delivered pay the postman only $5.00 plus a few cents carriage charge. Examine the books ten days. If, after you have seen them, you are in any way dissatisfied with them, you may return them, and your money will be cheerfully refunded.

HUNDREDS OF EXPERTLY DRAWN PICTURES LIKE THESE SHOW YOU AVIATION'S EVERY SECRET



Scores of meteorological drawings explain clearly the behavior of weather and the safe levels for flying under every possible weather condition.—From THROUGH THE OVERCAST.



SPERRY GYRO-HORIZON (SEMI-SCHEMATIC HORIZONTAL CROSS-SECTION)

Cross-section of Sperry Gyro-Horizon, showing all important parts.—One of dozens of pictures of the latest Sperry, Kollsman, RCA, Frieze, and other instruments, from THROUGH THE OVERCAST.

Graphic step-by-step representation of a flying maneuver.—One of hundreds, from YOUR WINGS.

Tear out, sign and mail to
FUNK & WAGNALLS COMPANY
Dept. 1892, 354 Fourth Ave., New York, N. Y

Send me the books I have checked below. When the postman delivers them, I will deposit with him the price indicated, plus a few cents postage. I understand that if I am in any way dissatisfied, I may return both or either of these books within 10 days for full refund of purchase price.

☐ **THROUGH THE OVERCAST and YOUR WINGS, boxed, $5.00.**

☐ Through the Overcast, $3.00. ☐ Your Wings, $2.50.

Name.....

Address.....

City & State.....

NOTE: Check here ☐ if you enclose remittance with order, in which case books will be mailed post free. Same return privilege applies.

Aircraft builders can employ Aero I.T.I. graduates with full confidence that the complete training system and equipment at Aero I.T.I. have produced men thoroughly versed in actual aircraft manufacturing processes and operations.

EXECUTIVE BOARD

JOHN K. NORTHROP
Formerly—President, The Northrop Corporation; Vice-President, Douglas Aircraft Company, Inc.

C. A. VAN DUSEN
Vice-President, Consolidated Aircraft Corporation

ROBERT E. GROSS
President, Lockheed Aircraft Corporation

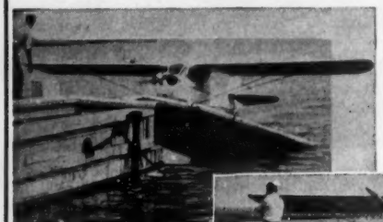
The Executive Board directly supervises the policies, management, and operation of this institution.

ENTRANCE REQUIREMENTS—LIMITED ENROLLMENT
Descriptive Literature on Courses Available

AERO INDUSTRIES TECHNICAL INSTITUTE

5261 WEST SAN FERNANDO ROAD, LOS ANGELES, CALIFORNIA

MARIANNO LIFT RAMP



in operation at Port Newark, N.J.

Above: Ramp will take care of Seaplane, Flying Boat, or Amphibian submerged under 7 feet of water, will submerge at 7½ degrees slope.

Right: Ramp in horizontal position.

NEW in principle, this electrically operated ramp provides quicker, safer, more economical seaplane operation, insures savings in first cost, in operation and maintenance as compared to other existing ramps. Can be attached and operated from piers, boats, floats or barges on any body of water.

Safety and Comfort for Passengers—Money Saved for You

Aviation authorities who know seaplane ramps say "the finest ramp—and the cheapest to own we have ever seen." Unaffected by ice or other climatic conditions—fully mechanical—operates at half the cost of any other now being manufactured. Can be designed for any capacity seaplane up to 100 tons.

Write for engineering details or demonstration.

MARIANNO SEAPLANE RAMP COMPANY

Times Building, Room 1901 New York, N. Y.

Newark, N. J., Phone: MArket 2-0937

SOLAR

AT THE RACES!

BENDIX

1st 3 PLANES SOLAR EQUIPPED

Jacqueline Cochran
Frank Fuller, Jr.
Paul Mantz

THOMPSON

1st Place Roscoe Turner

WINNING PILOTS know that there is no substitute for experience in the making of Exhaust Manifolds! It pays to specify "Exhaust Manifolds by Solar."

SOLAR EST. 1927 CO.

SOLAR Aircraft

LINDBERGH FIELD SAN DIEGO

Do you know that . . .

each month our subscription department receives more than 150 requests for "back" issues of AVIATION?

•

If we printed extra copies of our monthly issues, we would be glad to comply with these requests, but unfortunately we have no way of knowing in advance just how many of our newsstand readers will "miss" an issue.

•

***But We Do Know*—that each of these requests indicates a reader has "missed" just the issue he could make valued use of.**

Insure your receiving AVIATION *regularly by filling in the coupon below, today . . .*

AVIATION
330 W. 42d St., New York City
Here is my check for $3.00. Send me Aviation for one full year.

Name .....

Address .....

City and State .....

Nature of Activity .....

SUBSCRIPTION RATES:
United States, Mexico and Central and South American countries, $3 a year; Canada (including duty), $3.50 a year; All other countries, $6 a year or 30 shillings. Member of A.B.C.

Powered with 70 hp and 90 hp LeBlond motors

REARWIN MAKES TWO BIG ANNOUNCEMENTS!

1 All Sportster models granted 2S rating. **2** Sportster Model 7000 reduced $400.00.

First, 2S rating!

On October 14, all Rearwin Sportster models were granted 2S rating. Now a license earned after flight test in any Rearwin Sportster model entitles a pilot to fly any single engined airplane with a gross weight up to 4000 lbs.

Second, price reduction!

Now you can buy the Rearwin Model 7000 for only $2,195.00, a reduction of $400.00. And Rearwin standards of quality remain the same—the only change is in price.

No other airplane offers you so much for so little money. With its 2S rating, sturdy construction, outstanding appearance, unusual performance, great comfort, unusually safe flying characteristics, and new low price, the REARWIN Sportster is ideal for school operators, flying clubs, and private owners.

Don't wait . . . buy NOW while the price is so astonishingly low. Mail or wire your order today.

REARWIN AIRPLANES

Eleventh Continuous Successful Year

Fairfax Airport . . . Kansas City, Kansas, U. S. A.

"REARWIN popularity is proof of REARWIN superiority"

PUT "Live Action" TO WORK FOR YOU

. . . It cuts maintenance time and labor

The hours of work, usually required to keep your equipment at its most efficient degree of tightness can be reduced considerably. It's a proven fact that by equipping with

UNSHAKO

The Nut that can't shake loose

Vibration can't get in its dirty work. These nuts have a built-in locking ring that is always ready to spring to life and grip the bolt or stud as soon as a backing off tendency occurs. You just know they're always tight. Furthermore, their one piece construction saves fumbling and fussing with separate locking devices. It will pay you to investigate "Unshako." Write.

Fig. 1810

Cut away view showing locking ring in place. Pat'd. and Pat's. Pending

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS — JENKINTOWN, PENNA. Box 566 — BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

RYAN ST-M
The World's Leading Training Plane, used by the air forces of progressive nations throughout the world. Proven superior for both primary and advanced training. Modern metal construction, perfect flight characteristics, moderate in price, and lowest in operating and maintenance costs.
Cable Address RYANCO
Ryan
RYAN AERONAUTICAL CO., LINDBERGH FIELD, SAN DIEGO, CALIF.

When Safety hangs by a thread

you can depend upon

SWITLIK Safety Chutes

Every thread that goes into Switlik Safety Chutes is pretested for strength far in excess of the severest possible demands. Other exclusive safety and comfort features, absolute infallibility, compactness and lightness are additional reasons why, since 1930, we have furnished 57% of all the parachutes purchased by the U. S. AIR FORCES. Every type available for all commercial and military purposes. Switlik Chair Chutes now installed by the plane builder before delivery to you. Send today for your copy of free bulletins and catalogs.

Manufactured under Approved Type Certificates awarded by the U. S. Department of Commerce.

West Coast Dealer, Finney's Parachute Service, Alhambra Airport, Alhambra, California.

SWITLIK PARACHUTE & EQUIPMENT CO.
S. BROAD & DYE STS. . . . . TRENTON, N. J.

When you want Men

put your advertising for them on the same basis as other publicity.

If you want competent and efficient executives or assistants, experienced in the field served by this journal, you will naturally find the keenest and most progressive men in the industry among the readers of this paper. You can get their attention through a Position Vacant advertisement or possibly find the man you want among the Position Wanted advertisers in

AVIATION "CLASSIFIED".

QUALITY FIRST
B·H
AIRCRAFT COMPANY

FABRICATORS OF SHEET METAL AND TUBULAR PARTS FOR AIRCRAFT

Contractors to the Government and leading manufacturers

B. H. AIRCRAFT COMPANY
BREWSTER BUILDING, BRIDGE PLAZA
LONG ISLAND CITY, N. Y.

Standard Equipment!

CONTINENTAL

FRANKLIN

LYCOMING

MENASCO

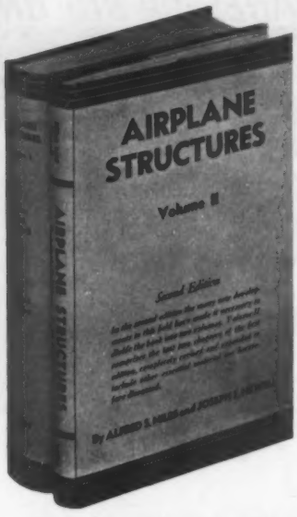
These excellent small-plane engines, so admirably serving sportsmen-pilots everywhere, naturally require ignition reliability beyond question—particularly when a single magneto is employed. The SF4 Bendix aircraft magneto is Scintilla's answer, universally approved.

SCINTILLA

MAGNETO COMPANY, INC.

(Subsidiary of Bendix Aviation Corporation)

SIDNEY, NEW YORK



AIRPLANE STRUCTURES

By ALFRED S. NILES

and

JOSEPH S. NEWELL

Second Edition 1938

These books present a completely up-to-date discussion of design procedure for airplane structures.

The content is in agreement with the latest data from the Army-Navy Commerce Committee on Aircraft Requirements.

VOLUME I

Contains chapters on General Design Procedure; The Critical Loading Conditions; Reactions, Shears, Moments, and Influence Lines; Beam Deflections; Continuous and Restrained Beams; Design of Simple Beams; Torsion; Truss Analysis; Graphical Methods; Design of Simple Ties and Columns; Connections; and Deflections.

451 pages **225 illustrations** **6 by 9** **$5.00**

VOLUME II

Offers full discussions of Statically Indeterminate Structures, and Beam-Columns.

177 pages **108 illustrations** **6 by 9** **$2.75**

■

"An excellent reference for the designer"

ON-APPROVAL COUPON

John Wiley & Sons, Inc.
440 Fourth Avenue, New York, N. Y.

Kindly send me, on ten days' approval, a copy of the following:

☐ **Niles-Newell, Vol. I, $5.00** ☐ **Niles-Newell, Vol. II, $2.75**

If I decide to keep the books I will remit their price plus postage; otherwise, I will return them postpaid.

Name .....

Address .....

City and State .....

Employed by .....

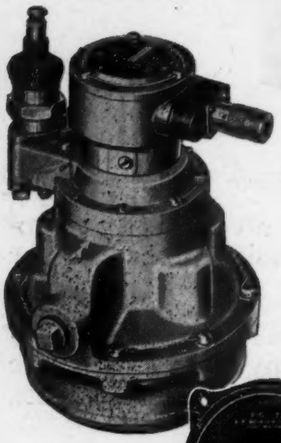
Av-11-38

ON SMALL PLANES OR BIG ONES

JUNIOR XACTO METER Tells

EXACTLY THE AMOUNT OF

FUEL CONSUMED!



Junior Xacto Meter and the Remote Reading Instrument.

Accurately Measures

. . . Accurately Records

Fuel consumption of motors . . . in flight or on test blocks.

There's no need to be continually "up in the air" about fuel consumption—no longer any need to wonder how much has been consumed. You can know—to the fraction of a gallon exactly how much has been used—with the time-tried

Junior Xacto Meter—the meter especially designed for aircraft service. Proved in actual flying service—tested by prominent airplane builders—airline operators and numerous government and private aviation engineers—the Junior Xacto Meter is pronounced the ideal answer to the problem of checking fuel consumption—accurately.

For large planes or small ones—commercial operators or private owners—for engine test blocks, install the Junior Xacto Meter for dependable accuracy. Get complete facts.

S. F. BOWSER & CO., Inc.
1309 Creighton Ave.
Fort Wayne, Indiana, U. S. A.

XACTO Junior
THE METER OF LABORATORY ACCURACY

BOWSER

PIONEER MANUFACTURERS of REFUELING SYSTEMS AND FUEL CONSUMPTION METERS

Jobs!
Jobs!
Jobs!

Here is a book to bring you nearer to the job in aviation *you want.* Get the facts you need from men who know—clear up your questions as to work, training, requirements, etc., etc.

Just Published

GETTING A JOB IN AVIATION

BY CARL NORCROSS

New York State Education Department

374 pages, illustrated, $2.50

DR. NORCROSS has written a valuable book for all young men interested in aviation careers. He has traveled to all parts of the country, to all branches of the industry where he has asked a great many questions about jobs. The result is a frank and practical guide to employment possibilities in aviation.

If you could get in to see and talk with famous aeronautical engineers, or pilots, or employment managers of air lines and had an opportunity to ask, "How can I get a job—and what do you recommend?" you would jump at the chance to do so. The author has done just that for you.

This book can help you:

1. Find out the beginning qualifications for jobs in the particular field of work which interests you.
2. Tell how much money the training will cost and how long it will take.
3. Find out the work being done by persons following the branch of aviation you hope to enter.
4. Decide whether you can meet the entrance requirements for the job you have in mind.
5. Gain exact information as to the number of jobs in aviation now open and a *forecast* as to the number of future jobs in different lines of aeronautical work.

EXAMINE IT 10 DAYS—SEND THE COUPON

McGRAW-HILL ON-APPROVAL COUPON

McGRAW-HILL BOOK COMPANY, INC.
330 West 42d Street, New York, N. Y.

Send me Norcross—Getting a Job in Aviation, for 10 days' examination, on approval. In 10 days I agree to pay $2.50 plus few cents postage and delivery, or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name .....
Address .....
City and State .....
Position .....
Company .....Av. 11-38

(Books sent on approval in U. S. and Canada only.)

IN THE FRONT LINE OF DEFENSE

CURTISS-WRIGHT AND BERRYLOID AIRCRAFT FINISHES

JUST as Army and Navy experts both here and abroad recently selected Curtiss-Wright Planes for exacting national defense work on the basis of fine performances, so were Berryloid Aircraft Finishes named to give these fine planes an extra measure of protection in service.

Among the several Berryloid Products to achieve this signal distinction were: 1. Lionoil, secret-processed coating for wood and metal; 2. Berryloid Zinc Chromate Primer, P-27b, the most highly anti-corrosive lightweight primer made; 3. durable Berryloid Pigmented Dopes; and 4., Berryloid Military Lacquers.

The Industry's Choice

Manufacturers of private and commercial aircraft, airline operators and individual plane owners everywhere have long made Berryloid Aircraft Finishes their first choice for service and economy. Berryloid Aircraft Finishes are distributed by Air Associates, Inc., Roosevelt Field, L. I.; Municipal Airport, Chicago, Ill.; 1100 Airway, Glendale, Cal.; Dallas, Texas; Marshall, Mo.; as well as by their jobbers and dealers.

BERRY BROTHERS

PAINTS • VARNISHES
ENAMELS • LACQUERS
Factories: DETROIT, MICH., WALKERVILLE, ONT.

Branches: JERSEY CITY, N. J. • BOSTON, MASS. • CHICAGO, ILLINOIS • CINCINNATI, OHIO • ST. LOUIS, MO. RICHMOND, VIRGINIA

CLASSIFIED ADVERTISING

AVIATION'S MARKET PLACE

USED PLANES, ENGINES AND PARTS FOR SALE, TRADE OR WANTED
SPECIAL SERVICES OF DISTRIBUTORS, FIXED BASE OPERATORS, ETC.
(Sales and Service—Storage—Repairing—Charter—Aerial Towing or Exhibitions—Special Instruction)
EMPLOYMENT—SELLING—BUSINESS OPPORTUNITIES: OFFERED OR WANTED
Address AVIATION "Classified", 330 W. 42nd St., New York, N. Y. Phone: MEdallion 3-0700—Ext. 556

RATES: UNDISPLAYED, 10 cents a word, minimum $2.00. DISPLAYED, $6.00 per inch. Contract rates on request.

TO AVIATION READERS: THIS IS YOUR "MARKET PLACE"

For your convenience it now appears in an easier-to-read type face and the exclusive indexing feature of Aviation "Classified" is supplemented with the group classification of one-plane ads. Check the groups and the index for ads of planes or other items that interest you. Jot down the numbers given and consult these ads. Numbered ads appear in numerical order. See how easy it is to use Aviation's Market Place to Buy. Use it when you want to Sell.

Used Planes

for sale—Grouped by Make

See index for additional planes offered in other ads. Ads appearing in group form are keyed to indicate that they also cover P—Parts T—Trades W—Wanted

Aeronca

AERONCA K: New July 1937. Privately owned, never scratched: total hours 400; brakes, two doors, tailwheel, heater, compass, other extras. $750. FS 458 330 W. 42nd St., New York City.

AERONCA K, 1937 Model. Licensed to Aug. 1939—Total time 38 hours. Any reasonable offer accepted. John Fick, Altamont, N. Y.

AERONCA C3 $280—Needs left wing, landing Y's prop. Rest is in licensed condition. Motor is A1 shape. Extras: 5 gal. gas tank wobbie pump, heater, Pioneer Compass. M. Lingle, Hershey, Pa.

AERONCA K-100 hours, never cracked, compass, wheel pants, heater, extra door, $1000.00. H. G. Noffsingerfi Jr. Business Mgr., V I. College, Bristol, Va.

Arrow

ARROW SPORT powered with Ford V 8. Financed. Safair Inc., Roosevelt Field, Long Island, N. Y.

Beechcraft

225 Jacobs 1935 Beechcraft, with improved shock absorbing landing gear, in excellent shape, never cracked, complete with gyro compass, artificial horizon, all blind flying instruments, 90 gallon gas tanks, landing lights, flares new Learadio compass, new Learadio two-frequency transmitter, new Learadio three-band receiver, Learadio Motoreel, simultaneous radio range filter, noise limiter. Priced for a quick sale for cash. F.S. 455, 330 W. 42nd St., New York City.

Bird

WARNER 125 H.P. BIRD. General Streamline wheels, Navigation lights, Breaks. No restrictions. A buy at $1285.00. Ferris & Sinclair, Flying Service, Muskegon County Airport, Muskegon, Mich.

Buhl Pup

BUHL PUP, Szekely 45 clip wing. Licensed to Feb. 1939. Price $325. Write for details. Albert Radune, 168 Columbia St., New Britain, Conn.

INDEX

AVIATION "Classified"—November, 1938

Undisplayed ads offering only ONE make of plane are grouped under that make. Others appear under "USED PLANES—General" and are numbered and indexed to enable readers to conveniently locate the makes of planes offered, or other items of interest. All other undisplayed and displayed ads—excepting those relating to employment and business opportunities—are numbered, or referred to by number, and indexed for the reader's convenience in quickly finding ads.

Used Planes

GENERAL 1, 2, 21, 45

BY MAKE:
Aeronca 33, 44, 45
Arrow Sport 33
Beechcraft 33, 45, 52, 53
Cessna 33
Fairchild 33
Ford 45
Howard 33, 45
Lockheed 33
Pitcairn 24
Rearwin 28
Ryan 33, 45, 52
Stinson 30, 33, 44, 45, 53
Taylor (Cub) 33, 45
Taylorcraft 28, 45
Travelair 28
Vultee Transport 50
Waco 33, 45
Engine and Parts 2a, 3, 4, 6, 21, 26a, 34, 42, 50, 52

EQUIPMENT & PRODUCTS:
See Classification and/or Numbers as follows:
Accessories and Supplies 21, 41, 42, 54
Books 48
Cameras 7
Catalogs 16, 20, 42
Dope 8, 37
Fuses 21
Hangars, Portable 29
Instruments 42
Magnetos 26a
Materials 49
Miscellaneous 5
Name Plates 10
Office Equipment 11
Parachutes 9
Propellers 26a, 27
Skis 12
Tires 26a
Wheels 26a
Wheel Pants 13

SERVICES AND INSTRUCTION:
See Classification and/or Numbers as follows:
Instruction 14, 15, 22, 26, 28, 29a, 47, 51
Repairing 23, 42
Sales 21, 30
Schools 17, 18, 19, 22, 23, 25, 26, 32, 33, 35, 36, 39, 40, 43, 51
Storage 52

TRADE: *(See ads keyed "T" and Classif.)*
WANTED: *(See ads keyed "W" and Classif.)*
EMPLOYMENT: *(See Classification)*
BUSINESS OPPORTUNITY 46
(Also see Classification)

Cessna

CESSNA C 37. Privately owned, never damaged. Total time 150 hours. Complete Blind Flying Equipment. Must sell at once. Cash sale $3800. Aeroplane and engine in perfect condition. Rochester Aeronautical Corporation, Rochester Airport, Rochester, N. Y.

Curtiss, Wright

CURTISS WRIGHT Sedan. Powered with J 6 7 E. generator, electric starter, Grimes Electric Retractables landing lights. Excellent Aeroplanes for Aerial Photography. Financed Safair Inc., Roosevelt Field, Long Island, N. Y.

Fleet

FLEET KINNER recovered in 1937. Pioneer instruments both cockpits. Grimes Position and Electric retractable landing lights. Financed Safair Inc., Roosevelt Field, Long Island, N. Y.

FLEET WARNER on late type. Edo Pontoons also land Gear. Direct Electric starter. 150 hours since major overhaul. Financed Safair Inc., Roosevelt Field, Long Island, N. Y.

Loening

LOENING COMMUTER AMPHIBIAN J69D. Ship and engine completely majored, licensed July 1939. 400 hours total time. Never salt water. $2000.00. Trades accepted. Douglas Burton, Lake George, N. Y.

Moth

D.H. GIPSEY MOTH. Ship completely recovered, engine overhauled. Licensed to June 1939. Great performer. E. C. Flavell, c/o Doherty, 33 Roosevelt St., North Arlington, N. J.

Porterfield

1938 YELLOW DE LUXE PORTERFIELD, total hours 110, 90 H.P. Warner, just like new. $2,750. E. V. Wing, Gerber, Calif.

Robin

CHALLENGER ROBIN, excellent condition, landing lights, navigation lights, compass, Hamilton Prop. starter, bank and turn licensed until June 1939 $850. Will deliver for expenses. Toby West, 9 N. Boulevard, Richmond, Va.

Ryan

RYAN B-5: 6PCLM. J6-9, majored. Ship refinished. Just relicensed. New steel prop, complete instruments, Bendix wheels and brakes. Ready to fly. Best offer or small ship trade. C. Strong. 1702 N. LaSalle St., Chicago, Ill.

AVIATION'S MARKET PLACE

Stinson

FOR QUICK SALE: Two airline majored Stinson T'S excellent condition little time. Radio equipped. Also spare radio's and parts. Strachan Skyways, Inc., Savannah, Ga.

Taylor (Cub)

CUB SEAPLANE-Landplane 1938. Continental 50. 2 months old. Marvelous performance, perfect condition, S. M. Barber, Greens Farms, Conn.

Private pilot's J 3 De Luxe 1938 sport Cub. 170 hours total time. Air speed, compass, turn and bank. Complete upholstery in excellent condition. Really exceptional motor. Looks and performs like a brand new ship. Never a minor damage. Must sell $950.00. Quick sale price. Anson Van Alstyne, 536 Oakdale Avenue, Chicago, Ill.

Taylorcraft

TAYLORCRAFT, year old, 165 hrs. black red trim, never cracked, compass cabin heater, tail wheel cool cowl, ball bank, always hangared. $925.00. Larry Geer, Ft. Dodge, Ia.

TAYLORCRAFT DELUXE; most beautiful Taylorcraft in U. S. Less than one year old. Cost over two thousand dollars. Fifteen coats of dope. Hand rubbed heaters, compass, breaks, pants, etc. Never damaged in any way or used for students. 140 hours total. Good reason for selling. Bargain $1300. Vince Mulac Municipal Airport, Traverse City, Mich.

1938 TAYLORCRAFT. White paint job. 140 hours. Brakes, compass, spinner, carburetor heater, leather upholstery, corrosion proofed, and sixteen inspection plates. $1300.00 cash. Always hangered. Dr. Pepper Co., Orlando, Fla.

1938 TAYLORCRAFT Demonstrators, DeLuxe and Standard models, priced to sell at once. May be financed. Aero Ways, Inc., Cleveland Municipal Airport, Cleveland, Ohio.

Travelair

SPEEDWING 46-5 Travel Air majored, Semi, brakes, compass, Air Speed, pressure gas gauge, primer, starter, cover, lights, duals, and aerial. Al Venditty, 4130 Springle Ave., Detroit, Mich.

TRAVELAIR J6-9 modernized D., 120 hours since major overhaul. Plane recovered a year ago. Completely equipped for aerial mapping and blind flying. Has two-way radio. Directional Gyro, Sensitive Altimeter, etc. Price with conventional instruments only $2000. Standard Aerial Surveys, Inc., Hackensack, N. J.

Vultee

V-1-A-VULTEE. Executive job. Privately owned and operated. Sixty hours since last major overhaul. Ship in perfect condition. George P. Fuller, 301 Mission Street, San Francisco, California.

Waco

FOR SALE—1935 Custom Waco U.O.C. 225 h.p. About one hundred hours since major, new leather seats, electric flares, landing lights, tail wheel lock. Complete set instruments, two way radio. Curtiss Reed metal prop, always privately owned, $2600. Located mid-west. FS 457 520 N. Michigan Avenue, Chicago, Ill.

WACO UKC DELUXE Less than four hundred hours total two hundred since major on engine. Sodium valves. Always privately owned. French grey. Blue stripe. Has turn and bank rate of climb, sensitive altimeter, head temperature. Two way radio, Navigation lights, wheel pants, complete duals with "Y" yoke. Cleanest best performing Waco this part of Country. Bargain $2850.00. R. J. White, 510 Madison Ave., Bldg., Memphis, Tenn.

OX WACO Recovered finished Red and Yellow licensed to October, 1939. Price $495.00. J. W. Newlon, 721 S. Arch St., Hannibal, Mo.

Trade

WANTED TO TRADE; 30 ft. Friendship style auxiliary sloop, stainless steel guy wires, etc; Will accept light aeroplanes or cars on trade. Jaros, 48-03 Ditmars Blvd., Astoria, Long Island, New York.

Used Planes—General

(See also Group Classifications)

NEW REPOSSESSED & USED AIRPLANES most all makes open and cabins at extremely low price, terms arranged. Write for November List. Pioneer Aircraft, Airport, Syracuse, N. Y. No. 1

AIRPLANE LOANS. We can arrange to finance or refinance your new or present airplane with small monthly payment. Finance Dept. Pioneer Aircraft Airport, Syracuse, N. Y. No. 2

Engines & Parts

Also see ads marked (P) in Groups

FREE AEROPLANE with motor purchase. Easy terms, $12.50 down. 200 pounds useful load. Welded steel construction. Propeller—all types—98c up. Sensational values. Illustrated information, and flying manual, 25c. Universal Aircraft, Fort Worth, Texas. No. 2a

WASP B. With engine driven generator. Write for details. E. F. Chadwick, Marysville, Wash. No. 3

New Cyclone F3 $5000.00. Used Cyclone F2B $1600.00. Overhauled Cyclone F2B $2500.00. New 300 h.p. Kinner $500.00. Cyclone, Wasp, Wright J-5, Wright J-6 and Hornet engine parts. KARL ORT, YORK, PENNA. No. 4

EXHIBITION BALLOON, hot air, used 6 times, $100. Hisso "A" engine $45. Reichert, 426 Hummel St., Harrisburg, Pa. No. 5

Selling out our entire stock of Lycoming parts. Complete assembly, any thing you need. Lowest cash prices. Also few J 5 parts. Strachan Skyways, Inc., Savannah, Ga. No. 6

Equipment & Products

Cameras

CAMERAS. Eastman Hawkeye Aerial, L type, 10", 4x5 plates, with lens, magazines; $75, very cheap; Fort, 2227 N. American St., Philadelphia, Pa. No. 7

Dope

ACETATE DOPE, not fresh stock but good usable dope, suitable for resale in cans; straw color; $22 for 55 gal. drum; 1000 gals. for $300. Henry K. Fort Co., 2227 N. American St., Philadelphia, Pa. No. 8

Parachutes

IF YOU ARE IN NEED of parachute equipment contact a responsible dealer who has used them and knows the type best suited to your purpose. In New York Area see Joe Crane, Irvin Air Chute Dealer, Roosevelt Field. No. 9

Name Plates

NAMEPLATES—white cord Bakelite, engraved to order. Prices reasonable; list upon request. A. L. Woody, 189-C, West Madison St., Chicago. No. 10

Office Equipment

OFFICE EQUIPMENT, save half, bargains in typewriters, duplicators, adders, check writers. Write for free list and save. Pruitt Bldg., Chicago. No. 11

Skis

SKIS: Used and reconditioned. Approved. Stock moving fast. Write at once for our attractive prices. Federal Aircraft Works. Minneapolis, Minn. No. 12

Wheel Pants

FOR SALE: Pair Undamaged Wheel Pants for low wing Aeronca. Cost $80. Will sell $20 F.O.B. Chicago. L. H. Fowler, 156 Roxbury Road, Garden City, L. I., N. Y. No. 13

Services & Instruction

Instruction

BLONDIN'S AIRCRAFT CHART. Authentic question answerer. 90 Pictures, $1.00. Blondin Chart Co., Box 34, Los Angeles, Calif. No. 14

RADIO, Engine, Sheet-Metal Courses now starting. Day and Night Classes. $57.00 up. Robertson Aviation School, St. Louis Municipal Airport, Robertson, Mo. No. 15

Catalogues

BROTHER CAN YOU SPARE A DIME—or two? Two new Catalogues are ready. One dime brings you either one. Two dimes bring you both. Specify whether you want Aviator's Personal Equipment Catalogue or Aeronautical Supply Catalogue, or both. Karl Ort, 605 W. Poplar St., York, Pa. No. 16

Business Opportunities

EXCLUSIVE GARAGE, Gasoline, Accessory and field service rights. Old field being rebuilt. Immediately adjacent to lodge. Year round resort. School rights. Write R. C. Keene, Mgr., Cambria Pines Airport, Cambria, Calif. No. 17

Employment

Position Vacant

STAFF ENGINEER, Power Plant Installation, wanted by large Eastern aircraft manufacturer. Desired qualifications include sound technical background, several years practical experience in power plant maintenance (preferably with a large airline), knowledge of latest current practice relating to installation requirements for high power output engines, including cooling and accessory systems, and capable of initiating advanced developments and research in this field. Responsible position. P-456, 330 W. 42nd St., New York City.

Position Wanted

A&E MECHANIC: American, 25. Six years experience all types aircraft and engines. Field, factory and air line experience. Now employed. Will go anywhere. Good references. Robert T. Gay, Danielson, Conn.

AIRPLANE AND ENGINE MECHANIC, licensed graduate Boeing School Aeronautics. Desires position, travel anywhere, good references, single. Aldo Vanoni, Saticoy, California.

Wanted

DANGER WANTED. Limited commercial pilot four years U.S.N.—Clean record, lazy, age 24—No acrobatic champion—power dives and legitimate propositions only. Give details first letter. 1635 W. Mulberry St., San Antonio, Texas.

WANTED TO BUY Airplanes, motors, parts, any condition. Will make cash offer. Wanted Challenger Motor and Motor mount for Travelair and Waco 10 wings. Tarkington Airport, W. 30th St., Indianapolis.

MOTORS Warner, Wright, Velie, Continental, Cirrus, OX 5, etc. for cash. E. Lovejoy, 1429 Nobles Lane, Carrick, Pittsburgh, Penna.

Page No.		Adv. No.
104	Aero Industries, Tech. Inst.	17
114	Aeronautics	18
114	Aircraft Service, Inc.	19
113	Air-Parts, Inc.	20
113	Ambrose, Inc., Frank	21
114	American School of Aircraft Inst.	22
9	Boeing School of Aeronautics	23
112	Boulevard Airport	24
117	California Flyers, Inc.	25
115	Curtiss-Wright Tech. Inst.	26
112	Dycer Airport	26a
114	Hartzell Propeller Co.	27
112	Indiana Air Service, Inc.	28
114	Irvin Aircraft Instrument School	29a
114	International Derrick & Eq. Co.	29
113	Leech Aircraft, Inc.	30
114	Littlefuse Laboratories	31
114	Luscombe School of Aeronautics	32
114	Mechanix Universal Aviation Service Co.	33
113	Menasco Manufacturing Co.	34
114	New England Aircraft School	35
5	Parks Air College	36
114	Phenix Aircraft Products Co.	37
113	Robbins Aircraft Sales, Reg.	38
119	Roosevelt Aviation School	39
118	Ryan School of Aeronautics	40
112	Simmonds Development Corp., Ltd.	41
113	Snyder Aircraft Corp.	42
116	Spartan School of Aeronautics	43
113	Stinson Aircraft Division	44
112	Stinson Airplane Exchange	45
112	Strachan Skyways, Inc.	46
114	Sundorph Aeronautical Corp.	47
112	Thompson Aviation Publishers	48
114	Titanine, Inc.	49
113	Vimalert Co., Inc., The	50
114	Warren School of Aero.	51
113	Whitney, O. J.	52
112	Wiggins Airways, Inc., E. W.	53
114	Wittek Mfg. Co.	54

(Classifiied Ads continued on following page)

AVIATION'S MARKET PLACE

U. S. Government

WAR DEPARTMENT, Office of the Contracting Officer, Air Corps, Materiel Division, Wright Field, Dayton, Ohio, June 24, 1938. To: Airplane Designers and Manufacturers.—The War Department invites the submission in competition by sealed communications of new designs covering Single-Engine, Radio-Controlled Target Airplane complete with all ground control and operating equipment, together with statement of price for which any such design in whole or in part will be sold to the Government. Communications containing designs and prices therefor must be submitted to the Contracting Officer, Wright Field, Dayton, Ohio, not later than November 16, 1938; no communications received after 1:00 P. M. Eastern Standard Time on said date shall be considered. Winner or winners of this competition will be determined as provided in the Act of July 2, 1926 (44 Stat. 788). The Government will require not to exceed one hundred (100) of the type of airplane referred to and will reserve the right to contract with a winner of the design competition for the construction of said airplanes in the event that said winner is qualified to manufacture same. A copy of the circular proposal covering this design competition and containing instructions in regard thereto will be furnished upon application therefor to the Contracting Officer, Wright Field, Dayton, Ohio. E. T. Kennedy, Major, Air Corps, Contracting Officer.

TIRES 850x10 2-4-6 ply $10, tubes new $4; 30x5 used $4; 32x6 $6; 22x10x4 **Wheels**, tire tube pr. $50; **BENDIX Wheels**, brakes, tires, pr. $35. **MAGNETOS** VAG9 $15; Dixie 800 new $12, etc. J5 Parts. NEW oil & fuel pump gear $4, thrust bearing $5, con rods $6, intake pipe $1. Rocker boxes $2, late cam & mag drive gear $17.50 etc. **PROPS** wood new Cirrus $25, LeBlond $25, OX5 $30.

DYCER AVIATION SUPPLIES

(Formerly Dycer Airport)

11156 S. Main St. Los Angeles, Calif.

PITCAIRN

MAILWING

Wright J 6-7—cruises a big load at 130 m.p.h. Instruments front and back. 90 hrs. since major, beautiful.

BOULEVARD AIRPORT

Philadelphia, Pa.

THEY USED

AVIATION "Classified"

"I sold my aeroplane in four days after the Ad appeared. I could have sold it ten times."

"I received forty replies and Five Cash Offers as the result of my advertisement in Aviation Classified."

"Every Instrument listed (there were 51 listed) sold —the day after the Ad appeared."

"The Advertised Engine was sold to a customer who stated he saw the Ad in Aviation."

Bargains in Used Planes

1937 Beechcraft 285 Jacobs, Landing lights. flares, bank and turn, rate of climb, thermacouple, Lear two-way radio, motor just overhauled, plane like new.
Price $6300

1934 Stinson 245 Lycoming, Smith Controllable prop. Radio receiver. Bank and Turn. Rate of climb. Other extras.
As land plane.....$3000
As sea plane.....$4300

1936 Stinson 245 Lycoming, Smith controllable prop, landing lights, flares, rate of climb, bank and turn, thermacouple, manifold pressure gauge. Flaps. Motor just overhauled. Condition of fabric and upholstery good. Beautiful color combination —gray and white.

E. W. WIGGINS AIRWAYS, INC.
Providence Rhode Island

LARGEST SELECTION CERTIFIED USED PLANES EVER OFFERED!

BARGAIN PRICES

Cubs - Aeroncas - Taylorcrafts - Wacos, Ryans - Beechcrafts - Howards - Ford and Stinson Trimotors - Open and Closed Planes of all descriptions.

Priced $500.00—Up

Write for Model desired and price you will pay.

STINSON DEALERS' AIRPLANE EXCHANGE
Wayne, Michigan

SIMMONDS DEVELOPMENT CORPORATION LTD

Dept. B, 551 5th Ave., N. Y. C., N. Y.

Seeks in all countries new types of aircraft and engineering accessories and components, preferably patented and established U. S. products, for development and production by the manufacturing companies of the

SIMMONDS GROUP
throughout the world

---

70 LeBlond Rearwin 1500

J6-5 Travelair Just Majored 1000

De Luxe Taylorcraft 1550

J-5 Travelair Just Recovered

INDIANA AIR SERVICE

INCORPORATED —

SOUTH BEND, INDIANA

On your way south be sure to visit Savannah

Free transportation to and from city

Approved Repair Station — Gas and Oil

See classified advertisements, under Stinson and Equipment & Parts Headings

---

BOOKS

Get Into Aviation!

Transport License Texts take the drudgery out of study. Write for circular.

THOMPSON AVIATION PUBLISHERS
8328 Woodward Ave. Detroit, Mich.

LEGAL NOTICE

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Aviation, published monthly at Albany, N. Y., for October 1, 1938.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared D. C. McGraw, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of Aviation, and that the following is to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, N. Y. C. Editor, S. Paul Johnston, 330 West 42nd Street, N. Y. C. Managing Editor, Leslie E. Neville, 330 West 42nd Street, N. Y. C. Business Managers, F. Dannhauser, 330 West 42nd Street, N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) McGraw-Hill Publishing Company, Inc., 330 West 42nd St., N. Y. C. Stockholders of which are: James H. McGraw, 330 West 42nd St., N. Y. C. James H. McGraw, Jr., 330 West 42nd St., N. Y. C. James H. McGraw, James H. McGraw, Jr., and Curtis W. McGraw, Trustees for: Harold W. McGraw, James H. McGraw, Jr., Donald C. McGraw, Curtis W. McGraw; Curtis W. McGraw, 330 West 42nd St., N. Y. C. Donald C. McGraw, 330 West 42nd St., N. Y. C. Anne Hugus Britton, 330 West 42nd St., N. Y. C. Mildred W. McGraw, Madison, N. J. Grace W. Mehren, 33 West Grand Ave., Chicago, Ill. J. Malcolm Muir and Guaranty Trust Co. of New York, Trustees for Lida Kelly Muir, 524 Fifth Avenue, N. Y. C. F. S. Weatherby, 271 Clinton Road, Brookline, Mass. Elsa M. Wilsey, Madison, N. J.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is. (This information is required from daily publications only.)

D. C. McGRAW, Secretary.
McGRAW-HILL PUBLISHING COMPANY, INC.

Sworn to and subscribed before me this 20th day of September, 1938.

[SEAL] H. E. BEIRNE.

Notary Public, Nassau County. Clk's No. 84. N. Y. Clk's No. 98. Reg. No. 0-B-90.

(My commission expires March 30, 1940)

Copy for "Market Place" Advertisements in the December Issue Required by November 16

AVIATION'S MARKET PLACE

Certified

USED PLANE

Bargains

SR3-B STINSON 'RELIANT' 1936: Gull Wing. 245 HP Lycoming—Controllable Propeller—Receiving Transmitting Radio—Landing Lights—Flares—Bank & Turn—Rate of Climb—Sensitive Altimeter—Thermocouple—Plus other Standard Instruments. Leather Upholstery. A BARGAIN. **PRICE $4,775.00**

SR9-CD STINSON 'RELIANT': 260 HP—Lycoming—Automatic Lubrication—Controllable Propeller—Bank & Turn—New Receiving & Transmitting Radio, Vertical Speed—Paint: Red Beige—Sensitive Altimeter—L65 Compass—Thermocouple—Landing Lights, Flares—Outside Air Temperature Gauge—Fuel Analyzer. **PRICE $7,948.00**

SR6, 1935 LYCOMING, 245 HP—Controllable Propeller, Bank and Turn, Rate of Climb, Radio, Landing Lights, Flares, Leather Upholstery, Color Cream Brown, low hours. **PRICE $2,975.00**

AERONCA LB 1936: 85 HP—Low Wing—Color: Yellow and Black—Closed Cabin—Full set Standard Instruments—Brakes—Tail Wheel—Flaps—Navigation Lights—Total Time 412 Hours—40 Hours since Major Overhaul. Never damaged. Cost new $3,450.00. **PRICE $1,400.00**

SR9-CD STINSON 'RELIANT': 260 HP Lycoming—Paint: Green and Black—Green Leather Upholstery—Controllable Propeller — Generator — Automatic Valve Lubrication — Bank & Turn — Vertical Speed Indicator — Manifold Pressure Gauge — RCA Receiver — Sensitive Altimeter—280 Hours with 60 Hours since Major Overhaul. **PRICE $7,150.00**

SM8A STINSON—Four place—Lycoming R-680—210 HP—Finish and Fabric good—Painted; Dark Green with Silver Trim—Silver just refinished—Landing Lights—Bank & Turn—Rate of Climb Indicator—41 Gallon Gasoline Tanks—Plus other standard Instruments. All Seats Reupholstered. Licensed to June 15, 1939. **PRICE $1,225.00**

All Planes Subject to Prior Sale

Phone — Wire or Write!

STINSON AIRCRAFT DIVISION
of
Aviation Manufacturing Corp.
Wayne, Michigan

Don't Let This Happen to You!

(READ WHAT THIS PILOT WRITES)

Kankakee, Illinois
October 12, 1938

Mr. Ray Snyder
Synder Aircraft Corporation
Municipal Airport
Chicago, Illinois

Dear Ray:

Congratulations on the installation of your new magnafluxing equipment.

I know every private and commercial plane owner feels that you will be able to give them the best assurance possible against any one of the numerous steel parts being crystallised and put back, in that condition, at the time of overhaul.

Ray, from my own personal experience last month, I feel you should encourage more major overhaul and less so called top overhaul jobs. In my case of being sold out of a ship, was due to just that one thing, not having my steel parts magnafluxed in time, my number five knuckle pin broke, letting the rod loose and completely ruining every part in the center case of my 760 Wright, and that meant practically a new motor. While I was in the East purchasing a motor, I left my ship in storage and it was completely destroyed in a hangar fire, so I am out of the flying business, due to not having my steel parts checked by the magnafluxing system. There is one thing that I am positive of, and that is that every motor I may own in the future, will be checked every four hundred hours.

Again I want to tell you how glad I am that you can give the private owner the same rigid inspection, as the air lines have used for years.

Sincerely yours,
Lawrence T. Schilling.

LTS:MLP

MAGNAFLUX SERVICE *by SNYDER*

Insist on Snyder Magnaflux service regardless of who overhauls your engine. Magnafluxing quickly and clearly shows cracks at the surface or under the surface. It will detect fatigue cracks too fine to be seen with a 100-power microscope. Magnafluxing guarantees the soundness of steel parts in your engine. Insist on this service. Fill out the coupon for complete information and prices. The same bulletin brings you prices on valve guides, valve guide installation and other engine service. Keep this information on hand. SNYDER AIRCRAFT CORPORATION OFFERS YOU THE ONLY MAGNAFLUX SERVICE IN THE MIDDLE WEST, CATERING TO THE PRIVATE AIRPLANE OWNER. IT DENOTES THE PROGRESSIVENESS OF A COMPANY WHO OFFERS YOU, AS WELL, NEW AND RECONDITIONED INSTRUMENTS, INSTRUMENT REPAIR SERVICE, FINEST GENERAL SUPPLIES AND FASTEST SHIPPING SERVICE. Consult Snyder's 1938 Catalog.

●YOU CAN HAVE A CONTINENTAL A40 OVERHAUL AS LOW AS $29.50! NEW LOW PRICES WITH PROMPT SERVICE THAT PUTS YOUR AIRPLANE BACK TO WORKING FOR YOU—ALL BY AN AUTHORIZED CONTINENTAL SERVICE STATION, WHERE YOU GET EXPERT SERVICE. Use the coupon to get further information about the four choices of service on Continental A40 overhauling. Keep it for quick reference.

USE THE COUPON

SNYDER AIRCRAFT CORP.
6056 South Cicero Avenue
Chicago, Ill.

Please send description of Magnafluxing and prices ☐
Please send Continental Overhaul Bulletin ☐

Name .....

Address .....

City ..... State .....

IN THE SOUTHWEST

Aeronca '35. Just majored	$ 600
Arrow Sport '37 Deluxe, gullwing	900
Beechcraft '36 Jacobs 285. Blind, night equipment. RCA Compass, transmitter	6750
Cessna '36. Warner 145. Blind insts.	3500
Cub '38. Just relicensed	850
Fairchild-24, Warner 145 HP., Radio	2750
Howard, Wright 320 HP. Blind, night equip. Two-way radio	8900
Lockheed Electra, Wasp Jr. engines	19500
Ryan SC Demonstrator	5850
Stinson '35. Lyc. 260 HP. Night, blind insts., RCA Compass, majored 50 hrs.	5950
Stinson Demonstr., Wasp Jr., 450 HP.	14950
Stinson '36 Wright 320 HP. Perfect cond.	8900
Waco AMB, '36 Wright 285. RCA Compass	6500
Waco '34 STD. Wright 250 HP. Just majored	3250
Waco '34 Continental 210 HP. Radio	2750

REG ROBBINS AIRCRAFT SALES
Municipal Airport — Fort Worth, Texas

Leech Aircraft, Inc.

STINSON

DISTRIBUTORS

Hangar F, Roosevelt Field
Mineola, L. I., N. Y.
Telephone Garden City 3308

Westchester Airport
Armonk, N. Y.
Telephone Armonk Village 308

VULTEE V-1A TRANSPORT

AIRPLANES

Ten Place Planes with Wright Cyclone Engines; New and Used Planes Available.

ENGINES

Manufacturer	*Type*	*H.P.*
Pratt & Whitney	Hornet	525–575
Pratt & Whitney	Wasp	450
Wright	J-6-9	300
Wright	Hispano	180–220
Curtiss	D-12	435
Curtiss	Conqueror	600

Engines Available in Quantities

THE VIMALERT COMPANY, Ltd.
813 Garfield Ave. — Jersey City, N. J.

Frank Ambrose, Inc.
Dealers and Exporters
Airplanes, Engines & Supplies
MUNICIPAL AIRPORT NO. 2
JACKSON HEIGHTS, NEW YORK CITY

NEW
WRIGHT GIPSY
AND
AMERICAN CIRRUS
PARTS
MENASCO MANUFACTURING CO.
6917 McKinley Ave., Los Angeles, Calif.

REASONABLE—RELIABLE—FASTER

AIR-PARTS INC.

GLENDALE — CAL., U.S.A.

New & Reconditioned Parts for All Aircraft Engines
Write for New Catalog and Mechanics Handbook

Cable: OJWINC, NEW YORK

BEECHCRAFT—RYAN
JACOBS ENGINES

9 ROCKEFELLER PLAZA

Est. 1922

O. J. WHITNEY, INC.
Store your ship in a well heated hangar this winter.

Telephone: Circle 6-7560
Airport: Esplanade 7-5600

NEW YORK, NEW ENGLAND
CENTRAL & SOUTH AMERICA

NEW YORK, N. Y.

AVIATION SCHOOLS

AIRPLANE MECHANICS
ARE IN DEMAND
We train you—Free Placement
Oldest in the West
WARREN SCHOOL OF AERONAUTICS
Ten years' successful operation in the airplane manufacturing center of the world
LOS ANGELES - - 235 W. 18th St.

New England
AIRCRAFT SCHOOL
Write for Illustrated Catalog. Gives complete data on Govt. approved courses in Aircraft Design, Engineering, Engines, Construction & Maintenance.
BOSTON AIRPORT **BOSTON, MASS.**

AIRCRAFT INSTRUMENT TECHNICIANS
Prepare now for this new field; the demand for traineld technicians exceeds the supply. Modern school, fully equipped. Government licensed instructors. Ref—any major instrument manufacturer. Write for details.
IRVIN AIRCRAFT INSTRUMENT SCHOOL
800 West 11th St., Los Angeles, Calif.

If you are considering a career in
AVIATION
Consult us regarding our Flight and Mechanic Courses
Our men are trained to train you
AIRCRAFT SERVICE, INC.
Cleveland Airport **Cleveland, Ohio**

AVIATION
If you are interested in a comprehensive Technical Training Program for
APPRENTICESHIP
MECHANICS PILOTS METEOROLOGISTS
Write, immediately, enclosing stamp—
MECHANIX UNIVERSAL AVIATION SERVICE CO.
Wayne County Airport, Box 957 Dept. F Detroit, Mich.

INSTRUMENT FLYING INSTRUCTIONS
Sundorph Aeronautical Corp.
Cleveland Airport

LEARN AVIATION!
If you want to learn Aviation write for this booklet, "Character, Vocation, Foresight". It's free.
AERONAUTICS DEPT. P,
Nauvoo **Illinois**

AVIATION NEEDS
Instrument Technicians
Because of the tremendous increase in the use of instruments, the aviation industry is faced with a great shortage of trained technicians. No other division is so under-manned. Instrument technicians are securing good paying positions with aircraft plants, air lines and civil service. Government approved instructors, day and evening classes, also a complete home study course, low tuition, easy terms. Write for an interesting free catalogue.
AMERICAN SCHOOL of *Aircraft Instruments*
AMERICAN SCHOOL OF AIRCRAFT INSTRUMENTS
3903 San Fernando Rd., Los Angeles, (Glendale) Calif. Dept. 21
Gentlemen. Please send me your free folder and further data.
Name_____
Address _____
City_____ State_____

WHAT ARE YOUR PLANS FOR 1939?
Have you considered using 1939 as a stepping stone to better earnings? Why not fit yourself for 1940's opportunities in the rapidly expanding field of metal aircraft construction where the shortage of trained technicians is a definite problem.
Qualify for these well paying positions by taking advantage of comprehensive
METAL AIRCRAFT INSTRUCTION
Recognized by all leading manufacturers
Course includes
CONSTRUCTION • MAINTENANCE • SHEET METAL FABRICATION • RIVETING • ENGINEERING • REPAIR ALUMINUM AND STEEL WELDING • ENGINES
Prepare for rapid Advancement by Supplementing Your High School or College Education With a Vocational
TRAINING IN METAL AIRCRAFT WORK
Exceptional placement service — over 90% of our graduates employed in the industry.
Get Complete Details of Our JAN. Class, Now Forming, By Writing For Our Free Folder,
"OPPORTUNITY IN AVIATION"
LUSCOMBE SCHOOL OF AERONAUTICS
West Trenton Division of Luscombe AIRPLANE CORP. **New Jersey**

ADDITIONAL ADVERTISING OF
SCHOOLS
WILL BE FOUND ON PAGES 5, 9 AND 104

WHERE TO BUY

NEW EQUIPMENT—ACCESSORIES—MATERIALS—SUPPLIES

PHENIX
AIRPLANE DOPES
CLEAR and PIGMENTED
PHENIX AIRCRAFT PRODUCTS CO.
5565 Main St. **Williamsville, N. Y.**

Small Ad — Big Story
Write for readable, illustrated catalog describing facts about fuses you should know.
Aircraft Littelfuses
Anti-vibration, fatigue resistant, super strong. Instrument and radio fuses. Neon potential fuses and Indicators. High and low voltage. Write
Littelfuse Incorporated
4264 Lincoln Av. Chicago, Ill.

TRADE MARK
NOC-OUT
HOSE CLAMPS
TYPE A Adjustable
Wherever *they know flying—*
Airplane manufacturers, transport companies, airfields and jobbers alike standardize on NOC-OUT Hose Clamps for design features, quality materials and an absolutely dependable all around seal.
TYPE A for replacement—Size adjustable with thumb screw.
TYPE GT for original equipment — easily installed and tightened in difficult places.
TYPE B bonding clamps—for Bonding, Grounding and Clamping tubing, Wire, braid. Sold by jobbers and dealers.
U.S. Pat. No. 1,385,813 & others
TYPE GT SOLID BAND
TYPE B BONDING CLAMPS
WITTEK MFG. CO.
4305 W. 24th Pl., Chicago, U.S.A.

STANDARD AIRCRAFT FINISHES
Since 1913
TITANINE
TITANINE INC. **UNION, N. J.**

HARTZELL PROPELLERS have efficiently served the United States **ARMY and NAVY AIR FORCES** for more than twenty years.
HARTZELL PROPELLER COMPANY
Piqua, Ohio

ALL STEEL HANGARS
We ship portable hangars all over the world —single plane size, or fleet capacity.
THE INTERNATIONAL DERRICK AND EQUIPMENT COMPANY
COLUMBUS, OHIO

AVIATION SCHOOLS

ACHIEVEMENT

The great Douglas DC-4 (weight 65,000 lbs.) leaving the ground for the first time, as seen by the entire Curtiss-Wright Tech student body. Note tricycle landing gear.

MORE CURTISS-WRIGHT TECH GRADUATES WORKED ON THE DC-4

than those of any other school. Curtiss-Wright Tech does not guarantee positions for its graduates—no reputable school would—BUT

Mr. Donald Douglas

PRESIDENT OF THE DOUGLAS AIRCRAFT CO., SANTA MONICA, CALIFORNIA

Says IN A LETTER TO MAJOR C. C. MOSELEY

"..... During the past several years, we have employed a large number of your graduates and have found them to be eminently satisfactory. Efficient workmen capable of working with the care and precision demanded by the Douglas Aircraft Company are the product of thorough training and are difficult to find. You are to be congratulated on the fine job your Institute is doing in turning out such men. ....."

No higher compliment can be paid Curtiss-Wright Tech and its graduates —nor is there any higher authority than Mr. Douglas.

Curtiss-Wright Tech is APPROVED by the U. S. Government, ACCREDITED by the State Board of Education, ENDORSED by the Aircraft Industry and offers specialized training only in

AERONAUTICAL ENGINEERING OR MASTER MECHANICS

Practical training for your career in the heart of the Aircraft Industry. The only U.S. Government approved school of its kind in Los Angeles County. No flying involved. Approved by the US. Department of Immigration for non-quota foreign students.

BE WISE—PROTECT YOUR FUTURE

MAIL TODAY! DON'T DELAY!

Without obligation please send me catalog and information on the courses I have checked.

MAJOR CAREER COURSES

○ **AERONAUTICAL ENGINEERING** — All-embracing scientific course for a highly paid professional career in designing and engineering modern all-metal planes.

○ **MASTER MECHANICS**—Complete course for a successful career in airline maintenance or factory production. Embraces all mechanics, including aircraft sheet metal work.

SUPPLEMENTARY COURSES

○ **POST GRADUATE ENGINEERING**—(for engineers holding B. S. degrees.) To enable graduate B. S. engineers to convert their previous training into Aeronautical Engineering without again covering math, drafting theory and fundamentals of stress analysis.

○ **AIRCRAFT SHEET METAL**—Intensive training in aircraft factory sheet metal work incorporating latest and most modern practices.

○ **HOME STUDY DRAFTING**—Prepares you as a Draftsman for aircraft factories. All manufacturing starts on the drafting table.

NAME _____ Age _____ Date I Plan to Enroll _____

ADDRESS _____ City _____ State _____

CURTISS-WRIGHT TECHNICAL INSTITUTE

UNDER PERSONAL SUPERVISION OF MAJOR C. C. MOSELEY, PRESIDENT

GRAND CENTRAL AIR TERMINAL, GLENDALE (LOS ANGELES) CALIFORNIA

AVIATION SCHOOLS

Your PLACE IS WITH THE Dawn Patrol

These are the type of wide awake ambitious young men that make up the DAWN PATROL—they come to Spartan from every part of the United States and many Foreign Countries.

HUMBERTO JOSE BONDALO BORGES
Macau, Portugese Colony

MANUEL FERNANDO REYES
Barranquille, Colombia

GENTIL da ROSA
Macau, Portugese Colony

JULIO A. RODRIGUEZ
Santurce, P. R.

LUIS ALFONSO CUELLAR
Barranquille, Colombia

Some of them come half way 'round the World to SPARTAN—for like the hundreds of others who preceded them as members of the DAWN PATROL, these young men KNOW they will leave SPARTAN equipped with the Training to fit them for ANY JOB IN AVIATION! A place is waiting for YOU in the DAWN PATROL—the opportunity for YOUR future in Aviation.

At Spartan YOU will HAVE . . .

The experience in training hundreds of students, many of whom today occupy positions of prominence in the Aviation industry.

SPARTAN occupies two of the largest and most modern hangars in the United States, equipped with modern Class-rooms, Radio and Machine Shops, Meteorology Department.

SPARTAN maintains modern Dormitories and an up-to-date Restaurant for the students well-being.

SPARTAN maintains its own private Landing Field in addition to the facilities of the Tulsa Municipal Airport, one of the highest rated in the country.

SPARTAN is directly connected with the SPARTAN AIR-CRAFT COMPANY, builders of the Military ALL-METAL ZEUS and Commercial EXECUTIVE — TODAYS MOST MODERN TRANSPORTATION.

HOME OF THE DAWN PATROL

Spartan SCHOOL OF AERONAUTICS

GOVERNMENT APPROVED

SPARTAN SCHOOL OF AERONAUTICS
P. O. BOX 2649, TULSA, OKLAHOMA

GENTLEMEN: Send me a copy of the NEW 1939 SPARTAN Catalog and Supplement describing in detail Spartan Flying, Mechanical and Radio Courses of Aeronautics, Tuition and detailed living expenses

NAME _____

ADDRESS _____

CITY _____ **STATE** _____

AGE _____ Any Previous Flying Experience? _____

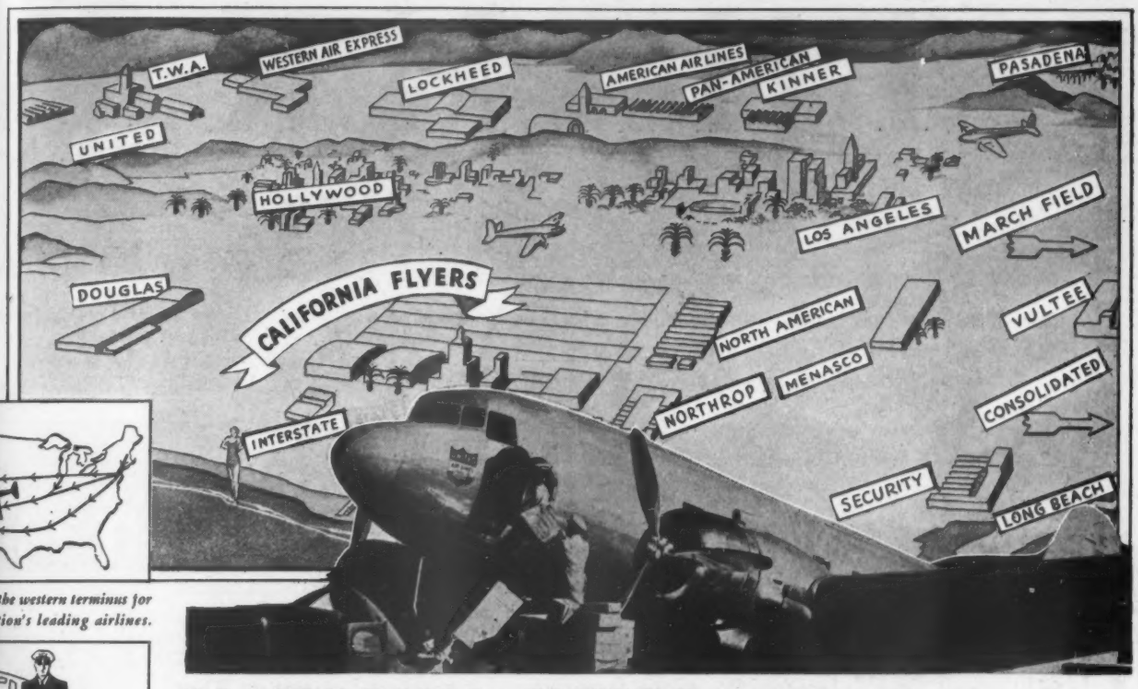
Check below branch of Aeronautics you are most interested in:

- ☐ FLYING
- ☐ MECHANICAL
- ☐ RADIO INSTRUMENT
- ☐ EXECUTIVE-MANAGEMENT

AVIATION SCHOOLS

CAREER TRAINING AND YOUR CAREER

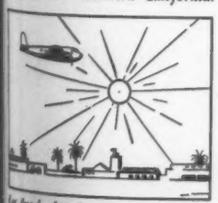
START *BOTH* IN THE NATION'S AVIATION CAPITAL



Los Angeles is the western terminus for five of the nation's leading airlines.

California has more licensed planes and more flying than any state in the union.

55% of all of the nation's planes are manufactured in Southern California.



Los Angeles has the finest year-around flying weather; best living conditions.

CALIFORNIA FLYERS—*NOT JUST A PLACE TO LEARN—A PLACE TO START YOUR CAREER*

California Flyers' students are not strangers in aviation. They know Who's Who and What's What. They know their way around long before graduation. Encircled by America's largest aircraft and air transport companies, valuable contacts are established in their early days of training. They know where they're going and how to get there. This is why many California Flyers' graduates in a remarkably short space of time occupy executive positions in aviation.

No industry is moving as swiftly as aviation. That which is new today is obsolete tomorrow. Ever changing, aviation insists that its future executives know, not only of today's developments but of tomorrow's achievements, be trained to tackle the problems that are coming—the DC-4's, the Unitwin Vegas, the interceptor and stratosphere planes. It is here in Los Angeles that these planes are developed; here at California Flyers where they are based for testing. In this beehive of aviation activity California Flyers' students start their career—learn aviation as it is today and will be tomorrow. No other school can offer this important phase of aviation training.

Here in America's aviation capital, California Flyers is the only nationally recognized flying-mechanical school. The only Government approved school offering complete courses in all phases of aviation training, flying, instrument flying, mechanics, drafting and aircraft construction. A squadron of modern planes provides varied types of flying equipment. The latest C-type Link Trainer gives the student the newest and finest in instrument flying instruction. California Flyers' mechanical departments are Government approved maintenance shops where work is done on planes in actual service. The school is modern, attractive and ideally located on a $3,000,000 mile-square airport.

Take the first step in your aviation career today. Send for this intensely interesting catalog and facts on training and employment opportunities. Start your training and your career here—now!

HIGHEST U. S. GOVERNMENT APPROVAL

CALIFORNIA FLYERS, INC.

SCHOOL OF AVIATION

LOS ANGELES MUNICIPAL AIRPORT · INGLEWOOD · CALIFORNIA

SEND FOR CALIFORNIA FLYERS CATALOG TODAY

CALIFORNIA FLYERS, INC.
School of Aviation, Dept. A-11
Los Angeles' Municipal Airport, Inglewood, California

Please send me your new FREE catalog *"Aviation Is Calling You."*
I am interested in subjects checked:

Flying ☐ *Mechanics* ☐ *Combined Courses* ☐ *Instrument Flying* ☐
Drafting ☐ *Aircraft Building (Aircraft sheet metal)* ☐

Name_____ Age_____
Address_____
City_____ State_____

THANKS

to the Aviation Industry

THIS is a "thank you" and a pledge to the aviation industry. Thanks for 16 years of generous co-operation in hiring Ryan recommended graduates. Each succeeding year ever increasing numbers of Ryan trained men take their places with airlines, factories, and commercial operators. That these pilots, mechanics and engineers make good is best attested by your increasing demands for additional Ryan graduates. As America's oldest, yet most modern aeronautical school—and the only certificated school closely affiliated with an aircraft factory—we pledge that our recommendations will continue to be unbiased and based entirely on the student's training record, his personal character, and our opinion of his ability to satisfactorily meet your specifications—thereby maintaining the high standards that have distinguished Ryan men in your ranks.

RYAN

SCHOOL OF AERONAUTICS

LINDBERGH FIELD, SAN DIEGO, CALIFORNIA

FLYING • MECHANICS • ENGINEERING

A ROOSEVELT AVIATION SCHOOL GRADUATE

Major Alexander Seversky, the man who built the winning plane.

Miss Jacqueline Cochran, the lady who flew the winning plane.

The winning plane in the 1938 Bendix Trophy Race, built by Seversky and flown by Cochran.

WINS THE 1938 BENDIX COAST-TO-COAST RACE

MISS JACQUELINE COCHRAN, A GRADUATE OF ROOSEVELT AVIATION SCHOOL, won the 1938 Bendix Trophy Race. She flew a Seversky plane from Los Angeles to Cleveland, non-stop, a distance of 2,042 miles, in 8 hours, 10 minutes and 31 seconds. A marvelous performance which brought to Miss Cochran, as an outstanding pilot, and to Seversky, as an outstanding manufacturer, the plaudits of the aviation world.

Major Seversky says: *"Miss Cochran's feat does great credit to her ability as a pilot, and Roosevelt Aviation School should be proud to number her among its graduates."*

AVIATION TRAINING AT ITS BEST

WINTER CLASSES START JANUARY 3, 1939

ROOSEVELT AVIATION SCHOOL—at Roosevelt Field, Mineola, Long Island, N. Y.

Without obligating me, send details of course checked:

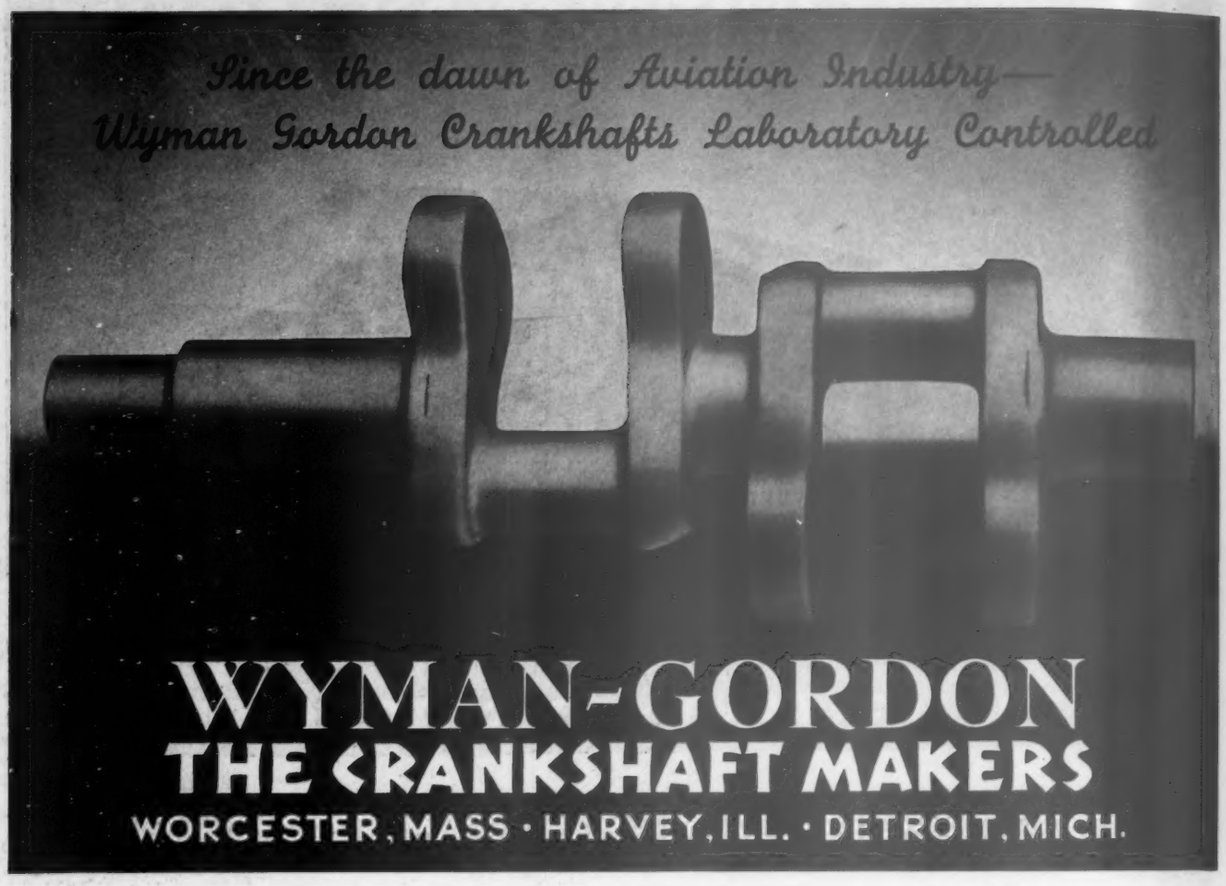
☐ SOLO PILOT ☐ COMMERCIAL PILOT ☐ LIMITED COMMERCIAL PILOT
☐ PRIVATE PILOT ☐ AIRCRAFT SHEET METAL ☐ AIRLINE TECHNICIAN
☐ MASTER AIRPLANE AND ENGINE MECHANIC ☐ MASTER AIRPLANE MECHANIC
☐ AIRCRAFT DESIGN AND CONSTRUCTION ☐ COMBINATION FLIGHT-MECHANIC

Name..... Age.....

Street Address..... Town..... State.....

A. NOV. 1938

SIGN AND MAIL COUPON TODAY


Since the dawn of Aviation Industry—
Wyman Gordon Crankshafts Laboratory Controlled
WYMAN-GORDON
THE CRANKSHAFT MAKERS
WORCESTER, MASS · HARVEY, ILL. · DETROIT, MICH.

INDEX TO ADVERTISERS

Aero Industries Technical Institute, Inc. 104
Albertson & Company, Inc. 4
Aluminum Company of America ..... Second Cover
American Screw Company 67
Aviation Manufacturing Corporation 87

B. H. Aircraft Company 106
Beech Aircraft Corporation 77
Bellana Aircraft Corporation 96
Bendix Products 16
Berry Brothers 109
Boeing School of Aeronautics 9
Bowser & Co., Inc., S. F. 108

Cleveland Pneumatic Tool Co., The 88
Classified Advertising 110-119
Curtiss Aeroplane Division 79
Curtiss Propeller Division 73
Curtiss-Wright Corporation 63
Consolidated Aircraft Corporation 75

Dart Mfg. Corporation 121
Douglas Aircraft Company 91

Eclipse Aviation ..... Back Cover
Electric Storage Battery Co., The 97
Ethyl Gasoline Corporation 85

Fafnir Bearing Co., The 64
Funk & Wagnalls Co. 103

Goodrich Rubber Co., The B. F. 46-47
Gulf Oil Corporation 52
Gulf Refining Company 52

Hartzell Propeller Co. 112
Hazard Wire Rope 90
Henschel Flugzeug-Werke, A. G. 109

Intercontinent Corp., The 14
International Derrick & Equipment Co. 112
International Nickel Co., Inc., The 10

Jacobs Aircraft Engine Co. ..... Third Cover

Kollsman Instrument Co., Inc. 98

Littlefuse, Inc. 112
Lockheed Aircraft Corporation 71
Lycoming 87

Marianno Seaplane Ramp Company 104
Martin Co., The Glenn L. 81
McGraw-Hill Book Co., Inc. 108
Menasco Mfg. Co. 94

Norma-Hoffman Bearings Corp 82
North American Aviation, Inc. 12

Pacific Airmotive Corp. 121
Parks Air College 5
Phenix Aircraft Products Co 112
Pioneer Instrument Co., Inc. 122
Piper Aircraft Corp. 3
Pump Engineering Service Corp. 84

Rearwin Airplanes 105
Ronald Press Co., The 51
Ryan Aeronautical Corp. 106

Scintilla Magneto Co., Inc. 107
Shell Oil Company 93
Solar Aircraft Co. 104
Spartan Aircraft Co. 8
Sperry Gyroscope Co., Inc. 69
Standard Pressed Steel Co. 105
Stearman Aircraft 101
Stinson Aircraft Corporation 89
Switlik Parachute & Equipment Co. 106

Texas Co., The 6-7
Titanine, Inc. 112

United Aircraft Corp.
Hamilton Standard Propellers 102
Pratt & Whitney Aircraft ..... Front Cover
Sikorsky Aircraft 95
Chance-Vought Corp. 83

Distinguished for Trustworthiness

. . . PRICED LOWER THAN YOU WOULD EVER EXPECT

To those who have bought DARTS, there seems to be an indescribable combination of qualities that mark its performance as truly trust-inspiring. Unmistakably there is a sense of complete *confidence* in its easy operation . . . *reliance* in its utter stability . . . *assurance* in its extraordinary flexibility. In fact, so trustworthy has it proved as a trainer that already a number of outstanding schools have become "repeat" buyers of this much-talked-about, economy plane.

FOR THOSE OF DISCRIMINATION AND OF LIMITED MEANS

DART

(2 Place—90 H.P.—135 M.P.H.)

DART MANUFACTURING COMPANY

Port Columbus • Columbus, Ohio

Inquiries Invited from established Foreign and Domestic Distributors

INDEX TO ADVERTISERS

Vultee Aircraft 99
Wellington Sears Company..... 92
Weston Electrical Instrument Corp..... 86
Wittek Mfg. Co..... 112
Wiley & Sons, Inc., John..... 107
Wyman-Gordon 120

SCHOOLS

Aero Industrial Technical Institute, Inc.....104
Aircraft Service Inc.....114
American School of Aircraft Instruments.....114
Boeing School of Aeronautics..... 9
California Flyers Inc.....117
Curtiss-Wright Tech. Inst.....115
Irvin Aircraft Instrument School.....114
Lussombe School of Aeronautics.....114
Mechanix Universal Aviation Service, Inc.....114
New England Aircraft School.....114
Parks Air College..... 5
Roosevelt Aviation School.....119
Ryan School of Aeronautics.....118
Spartan School of Aeronautics.....116
Warren School of Aeronautics.....114

AVIATION'S MARKET PLACE

(CLASSIFIED ADVERTISING)

BOOKS 112
BUSINESS OPPORTUNITIES.....112
EMPLOYMENT (Positions Wanted and Vacant).....112
FOR SALE (Used Planes).....110-111-112-113
INDEX of Planes, Engines and Parts For Sale.....110
PRODUCTS 111
SERVICES (Charter, Instruction, Repairing, Storage).....111
WANTED TO PURCHASE.....112

(CLASSIFIED DISPLAY ADVERTISERS)

All-Parts, Inc.....113
Ambrose, Inc., Frank.....113
Boulevard Airport.....112
Dyer Aviation Supplies. .112
Indiana Air Service, Inc....112
Leech Aircraft, Inc.....113
Menasco Manufacturing Co..113
Robbins Aircraft Sales, Reg. 113
Simmonds Dev'l Corp. Ltd..112
Snyder Aircraft Corp.....113
Standard Aircraft Equipm't. 90
Stinson Aircraft Division of Aviation Manfg. Corp. 113
Stinson Dealer's Airplane Exchange 112
Strachan Skyways Inc.....112
Sundorph Aeronautical Corp. 114
Thompson Aviation Publishers 112
Vimalert Co., Inc., The....113
Whitney, O. J.....113
Wiggins Airways Inc. E. W. 112

PARTS · SUPPLIES · SERVICE

PACIFIC AIRMOTIVE

UNION AIR TERMINAL, Burbank, California
SAN FRANCISCO AIRPORT, So. San Francisco, Cal.

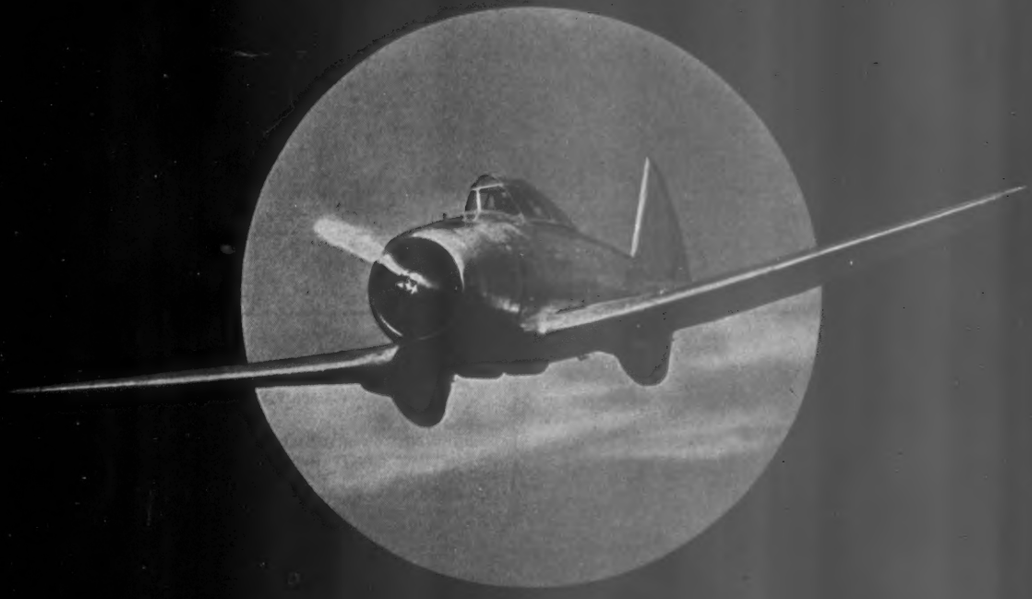
SEVERSKY AIRCRAFT

FIND IN

PIONEER INSTRUMENTS

THE RELIABILITY DEMANDED FOR

Record-Smashing Performance



Superb performance, demonstrated far beyond the point where there can be any element of doubt or argument, is what made Pioneer Instruments the natural selection for the record breaking aircraft of Seversky.

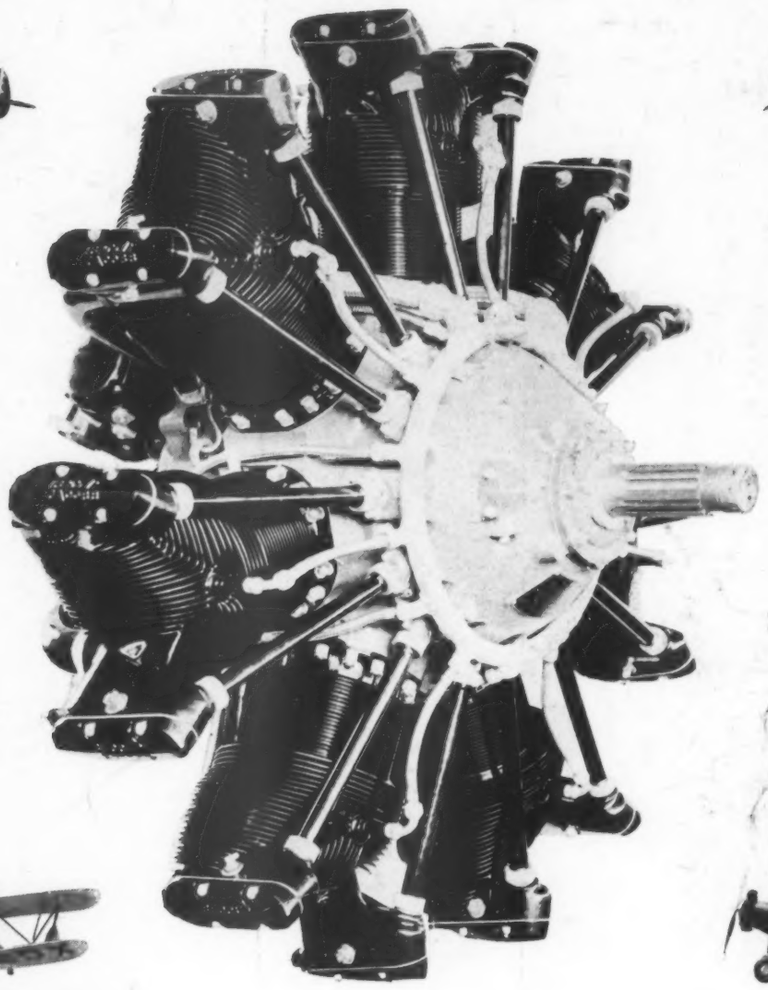
The numerous records established in Seversky airplanes of both military and commercial types have all been facilitated by the good instrumentation provided by Pioneer . . . the inevitable choice where Performance is Paramount.

PIONEER INSTRUMENT COMPANY, INC.

(Subsidiary of Bendix Aviation Corporation)

754 LEXINGTON AVENUE • BROOKLYN, NEW YORK

POWERED BY JACOBS



WACO "C"

WACO "N"

WACO "S"

HOWARD DG-A 9

FLEET FREIGHTER

BEECHCRAFT E17B

BEECHCRAFT 18B

FLEETWINGS "SEABIRD"

KELLET AUTOGIRO

FLEET TRAINER

In each of the past 3 years Jacobs Engines have powered more commercial and private airplanes than any other engines in the 200-400 H.P. classes, and their efficiency for light military aircraft is now receiving wide recognition throughout the world.

En cada uno de los últimos 3 años se usado más Motores Jacobs en aviones comerciales y particulares, que ninguna otra marca en las clases de 200-400 C.F., y su eficiencia para aviones militares de poco peso está siendo reconocida en todas partes del mundo.

In jedem der vergangenen drei Jahre haben Jacobs Maschinen für mehr geschäftliche und private Luftfahrzeuge den Antrieb geliefert als irgend sonstige Maschinen im Bereich von 200 bis 400 PS. Die zweckmässigkeit derselben für leichte militarische Luftfahrzeuge findet heute in allen Ländern weit verbreitete Anerkennung.

Au cours de chacune des trois dernières années, les moteurs Jacobs ont été montés sur un plus grand nombre d'avions commerciaux et particuliers que tout autre moteur dans la catégorie de 200-400 HP. Son rendement sur les avions militaires légers est maintenant reconnu dans le monde entier.

In ciascuno degli ultimi 3 anni si sono montati sugli aeroplani privati e commerciali più motori Jacobs che motori di qualsiasi altra marca della forza di 200 a 400 HP. e la loro bontà per avioni militari leggeri viene sempre maggiormente riconosciuta in tutto il mondo.

JACOBS AIRCRAFT ENGINE COMPANY

POTTSTOWN PENNSYLVANIA, U.S.A.

JACOBS AIRCRAFT ENGINES EFFICIENT - RELIABLE

Cables—JAECO, POTTSTOWN

ILLINOIS STATE LIBRARY
GENERAL LIBRARY DIV
SPRINGFIELD ILL

TOWARD *Safer* FLYING

Eclipse Mechanical "De-Icer" and Anti-Icer Equipment

Winter and high altitude flight, with its long recognized hazard of ice formation on wings, control surfaces, propeller blades and windshields, is measurably less a problem in aircraft employing Eclipse Mechanical "De-Icer" and Anti-Icer equipment.

Developed in close cooperation with the B. F. Goodrich Company, who manufacture the rubber overshoes for wing and control surface "de-icers," Eclipse Equipment reliably provides the vital actuating means which makes the whole system thoroughly effective.

All a part of progress toward safer flying. Interesting detailed information on request.

ECLIPSE AVIATION
DIVISION OF
BENDIX AVIATION CORPORATION
BENDIX, NEW JERSEY

Pictured above left to right: Eclipse "De-Icer" Oil Separator. Eclipse Electric Motor Driven "De-Icer" Distributing Valve; Eclipse Vacuum Relief Valve. *Below:* Eclipse Propeller Anti-Icer Pump; Eclipse B3 Air Pump (engine driven).